THE ECOLOGY OF

PHYTAL ANIMAL COMMUNITIES

by

Graham John Edgar B.Sc. (Hons)

submitted in fulfilment of
the requirements for the degree of
Doctor of Philosophy

UNIVERSITY OF TASMANIA
HOBART

October, 1982

([illegible])

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any university, and that, to the best of my knowledge and belief, the thesis contains no copy or paraphrase of material previously published or written by another person, except when due reference is made in the text.

CONTENTS Page

SUMMARY

The factors influencing the motile macrofauna associated with marine algae were investigated on spatial and temporal scales in order to determine how these assemblages are organised. Results from these phytal studies were also used to assess mathematical and biological aspects of the theory of diversity.

Water depth had the greatest influence on the distribution of the phytal fauna within a localised area. Within a depth zone, animal species ranged widely over most algal species, but there were quantitative differences in the abundances of the faunas on different algae. These differences partly resulted from a close correspondence between algal shape and faunal size structure.

Monthly sampling of the phytal assemblages associated with five algal species showed that the abundances of almost all animal species peaked at the time of a seasonal epiphyte bloom in late summer-early autumn, and faunistic differences between the erect algae were obscured at this time. These results, in conjunction with observed seasonal changes in the size-frequency histograms of four ampithoid amphipod species, and motility, predation and algal-selection experiments, provided evidence that cyclic fluctuations in phytal amphipod populations were directly influenced by epiphytic biomass and predation pressure. The ampithoid guild was probably also structured by competitive constraints.

Widely-used diversity indices were calculated for the phytal samples and compared. It was found that these indices could be grouped into those primarily influenced by dominance, those primarily influenced by species density, and those, such as the Shannon-Wiener Index, which were intermediate

between the other two groups. Evenness indices were also investigated but were found to be highly dependent on sample size and consequently difficult to interpret.

Environmental correlates of dominance and species density indicated that these two community parameters were relatively independent. Dominance and animal abundance both appeared to be monotonically increasing functions of the level of food resources. Species density was dependent on the weight of sampled algae but was also strongly influenced by wave exposure and habitat complexity (sensu number of habitats, rather than rugosity). Neither species density nor dominance were found to be greatly influenced over a 28° range of latitude.

Diversity parameters were considered to be helpful in the interpretation of the effects of external factors on communities. However, the lack of discrimination between dominance and the alpha and gamma components of species density in the past has resulted in much confusion on the causes of diversity.

ACKNOWLEDGEMENTS

I would like to thank the many people who have helped me in the preparation of this thesis. These include:

My supervisors; Dr A.M.M. Richardson for listening patiently and commenting judiciously, and Dr D.A. Ritz for criticism of the manuscript,

Glen McPherson for needed advice in matters statistical,

Ron Mawbey for field assistance, in particular help with the collection of subtidal samples in often trying conditions,

A number of other willing field helpers, especially Paul Cramp, Richard Holmes, Kit Williams and Barry Rumbold,

Peter Last for discussions over several years, including suggesting the topic for the study,

Many of my other fellow students, including Rob Sloane, Steven Smith and Chris Crawford, for their friendship and help,

Steven Andrewartha for the days spent writing many of the computer programs,

A number of taxonomists, notably Liz Turner, Terry Walker, David Staples, Dave Thomas, Dr J.L. Hickman, Dr G.C.B. Poore and Dr P.A. Hutchings,

Alison Maggs for collecting Sargassum samples at North Stradbroke Island, and thanks especially to

Dr P.G. Moore for his unceasing encouragement and interest in the study, not forgetting also his useful criticisms of the manuscript.

The study was supported by a University of Tasmania Postgraduate Research Grant.

CHAPTER 1: GENERAL INTRODUCTION

The aims of this study on the animal communities associated with marine macro-algae (phytal communities) were two-fold: to determine the processes which affect the distribution of animals within the algal environment, and to investigate differing theories on the control of ecological diversity.

Phytal assemblages were chosen as the topic of investigation primarily because they are poorly known in comparison to the animal assemblages found within other marine habitats. No previous phytal studies, other than those of a taxonomic nature (e.g. Barnard, 1972, 1974), have been reported from Australia, while the results of benthic and planktonic studies have been published relatively frequently (such as studies of Moreton Bay benthos by Stephenson et al, 1970; Indian Ocean plankton by Tranter, 1977; Port Phillip Bay benthos by Poore and Rainer, 1979; and Tasmanian plankton by Nyan Taw and Ritz, 1979). This is surprising in view of the considerable biomass of animals residing on macro-algae and the ready availability of these food resources to larger animals of commercial importance such as fish (Gore et al, 1981). The present study also differs from almost all other phytal investigations (one exception is the study of Dahl, 1948) by considering all motile phytal animals (above 0.5 mm sieve size) associated with a range of plant species, rather than being restricted to one algal species (e.g. Fenwick, 1976) or a predefined taxonomic group of animals (e.g. Warmke & Almódovar, 1963). It is unfortunate that the small and sedentary groups of animals needed to be excluded from the study

because many of the organisms not investigated would interact with those included in samples. Nevertheless, the addition of the microfauna, meiofauna and sedentary fauna would have considerably increased sorting time and drastically restricted the scope of the study.

The second reason for selecting phytal communities for study was because information relating to these assemblages can be used to compare diversity theories critically. Diversity is amongst the most controversial areas of ecology; not only are diversity theories often contradictory (Pianka, 1974), but the concept itself has been questioned (e.g. Hurlbert, 1971). Phytal samples are especially useful for testing the different hypotheses because samples are replicable, easily sorted, potentially rich in species (up to 100 macrofaunal species per plant) and the habitat complexity can be maintained as a constant by collecting algae of only one species. In fully marine regions free from pollution the environmental parameters are also readily defined by reference to depth, wave exposure, water temperature and the structure of the algal community.

The organisation of this thesis follows from the aims of the study. In Chapters 2, 3 and 4 the phytal system has been considered in its own right. Chapter 2 details the relative effects of depth and algal structure on phytal animals at a small study site at Fancy Point, Tasmania. The relationship between faunal size structure and plant morphometrics is particularly stressed in this study. The correspondence between the life histories of phytal animals, the phenologies of macroalgae and the seasonality of epiphytes is investigated in Chapter 3. Chapter 4 presents the results of a series of experiments which enable the factors affecting the distribution of ampithoid amphipods to be assessed. Ampithoid amphipods were chosen for detailed investigation

because they are among the most abundant components of phytal assemblages throughout the world (Nagle, 1968) and several species coexisted as a guild within the study area at Fancy Point.

The results of the studies described in Chapters 2 to 4 form the basis for a review of both the mathematical and biological aspects of diversity in Chapter 5.

CHAPTER 2: SPATIAL ORGANISATION OF PHYTAL COMMUNITIES

2.1 INTRODUCTION

Phytal communities are ordered by a variety of physical and chemical factors which include algal shape (Sarma & Ganapati, 1972; Hicks, 1977), water depth (Dahl, 1948), wave exposure and water movement (Norton, 1971; Fenwick, 1976), turbidity and detrital load (Dahl, 1948; Moore, 1973a, 1974), pollution (Jones, 1973; Sheppard et al, 1980) and salinity (Dahl, 1948). Determining the relative influence of each of these factors has proved difficult in the past due to interactions between them. For instance, different conclusions were reached in two investigations dealing with the Laminaria-associated fauna of the British coast because of strong inter-correlation between variables. Moore (1973a, 1974) considered turbidity as the main factor influencing the structure of the holdfast community, while Sheppard et al (1980) believed pollution to be more important.

In the present study, the effects of the variables water depth and algal structure on the phytal fauna have been compared at a small study site off south-eastern Tasmania. Previously, these variables have been studied independently. The zonation of phytal communities with depth was initially shown by the investigations of Kitching et al (1934) and Dahl (1948), and is generally recognized to be caused by diminishing wave turbulence with depth (Hagerman, 1966; Fenwick, 1976). Several authors have also shown that differences exist between the faunas of dissimilar algal species (Colman, 1940; Sarma & Ganapati, 1972; Warwick, 1977). Despite these findings, however, few attempts have been made to quantify algal shape or to determine to which

elements of shape animals respond. The relationship between the size structure of the phytal assemblage and plant shape has also been little studied. These aspects are stressed below.

2.2 STUDY SITE

The study site was a gently sloping sandstone reef at Fancy Point, Bruny Island, Tasmania (Lat. 43°13'S, Long. 147°21'E; Fig. 1). The rocky substratum sloped evenly from high water mark to a depth of ≃6 metres below low water mark, where it submerged under sand.

Wave exposure at the site is slight, due to the short fetch across D'Entrecasteaux Channel, but is still significantly greater than in the sheltered bays on either side of the point. Prevailing winds generally blow onshore from a westerly direction, but offshore sea-breezes frequently occur during summer.

Monthly temperature and salinity data for the period July 1978 to June 1979 are presented in the next chapter on seasonal variation (see Fig. 12), and longer term information for the northern section of D'Entrecasteaux Channel is described by Matthews and Volfram (1978). Water temperatures range from ≃8°C in August to ≃21°C in February. Salinities are slightly depressed from fully marine by discharge from the Huon River, and vary from 31‰ to 35‰.

Tides are small and semi-diurnal, with an amplitude similar to Hobart (0.9 metres between MHHW and MLLW).

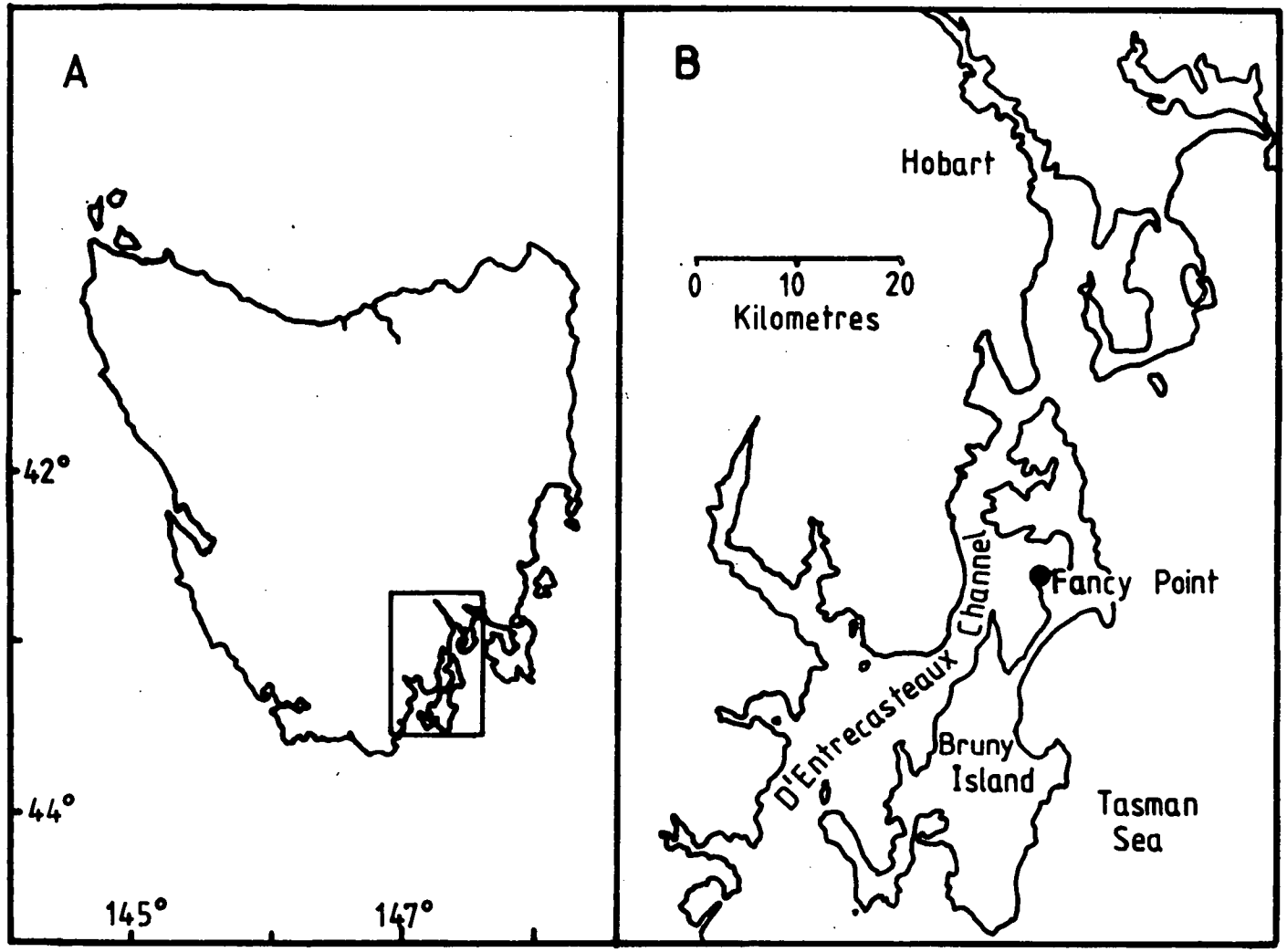


Fig. 1. Map of Tasmania (A) with the south-eastern region enlarged (B).

2.3 METHODS

2.3.1 Vegetation Profile

Three transect lines were laid from 0.2 metres above low water mark to the edge of the reef at ≃6 metres depth. Metal quadrats ($0.25m^2$) were placed at 2 metre intervals for the first 10 metres along the transect and then every 5 metres to the sand. The percentage cover of the different species of macro-algae was estimated for each quadrat and recorded on an underwater notepad together with information on the depth and distance from shore. The total wet weight of algae within each quadrat was also determined by scraping the vegetation from the quadrat, placing it into a mesh bag and weighing the bag and its contents using a spring balance on a boat moored nearby.

2.3.2 Phytal fauna

In order to minimise seasonal effects, all algal samples were collected and transects surveyed between the 11 November and 4 December 1980.

Quantitative samples of the prominent species of macro-algae were collected by enclosing individual plants within bags and tearing the plant plus its holdfast from the substratum. Small plants were collected in plastic bags while larger individuals were enclosed within 0.5 mm mesh bags and later transferred to plastic bags. Formalin (≃5%) was added to the contents of the plastic bags after transportation to the boat. The depth below the water surface was measured at each plant using a graduated line with lead weight and these measurements were corrected to low water mark. In this way five replicate samples of 23 species of algae and an additional ten replicates of

the deepest growing alga, Caulerpa trifaria (five from 2.8 to 4.6 metres and five from 5.8 to 6.1 metres), were collected. A further five replicates of both the holdfast and fronds of the kelp Ecklonia radiata were also taken. The Ecklonia frond was first enclosed within a bag and severed from the holdfast by cutting through the short stipe. The holdfast was then also surrounded by a bag and levered from the substratum with a knife.

No attempt was made to randomise the collection process. Individuals of common species were sampled from as wide a depth range as possible while rarer species were collected as they were sighted. Table I gives a short description of each algal species and the depths from which they were collected.

Motile animals were separated from the algae, and grouped into size classes, by vigorously shaking each plant in water within its plastic bag, removing the plant, and pouring the supernatant through a series of seven size-graded sieves. The extraction procedure was repeated until no further animals were retained by the sieves. Visible animals which remained entangled on the plant were removed by hand. A slight sampling bias was caused by the oversight of a proportion of small, elongate animals among filamentous algae. However, thorough hand sorting of several finely branched algae indicated that the procedure accounted for at least 95% of individuals.

The sieve sizes used in this study followed a log series (0.5 mm, 0.72 mm, 1.0 mm, 1.4 mm, 2.0 mm, 2.8 mm and 4.0 mm). For convenience these sieves will also be referred to as sieve sizes 1, 2, 3, 4, 5, 6 and 7 respectively. Animals collected on each sieve were sorted into species groups and counted under a binocular microscope. Non-motile animals (bryozoans, foraminiferans, sponges, sedentary polychaetes, bivalve molluscs and brachiopods) were excluded from all analyses. Individuals belonging to motile animal groups chiefly represented in the meiofauna (nematodes, copepods,

Table I. Algae sampled during the study. For each species the abbreviation used in figures, a short description, the maximum length and the depths from which individual plants were collected are given.

Rhodophyta

Hemineura frondosa Harv. (H.f.): Membranaceous plant with wide leaf-like thallus. Length 12 cm. Depths 1.2, 1.7, 3.2, 3.2, 3.4

Jeannerettia lobata Hook. & Harv. (J.l.): Elongate algae with membranaceous fronds arising from semi-rigid midribs. Length 31 cm. Depths 1.0, 1.2, 1.2, 1.2, 1.4 m.

Plocamium angustum (J. Ag.) Hook. & Harv. (P.a.): Compact, highly branched alga with tooth-like ramuli arising from thin, flat axes. Length 15 cm. Depths 1.0, 1.2, 1.2, 1.2, 1.9 m.

Phacellocarpus labillardieri (Mert.) J. Ag. (P.l.): Highly branched plant with rows of slender teeth along edges of thin, flat axes. Length 20 cm. Depths 1.2, 1.2, 1.3, 1.6, 1.7 m.

Thamnoclonium clariferum J. Ag. (T.c.): Erect, rigid algae with warty, terete axes. Length 30 cm. Depths 3.4, 4.2, 4.2, 4.5, 4.5 m.

Anotrichium sp. (A.sp.): Infertile, finely filamentous algae. Length 9 cm. Depths 2.0, 2.5, 2.7, 4.5, 4.5 m.

Table I (Cont.).

Chlorophyta

Caulerpa trifaria Harv. (**Ca.t.**): Rhizomatous algae with erect axes bearing three rows of filamentous ramuli. Length 13 cm. Depths 2.6, 2.7, 2.7, 4.2, 4.5, 5.7, 5.8, 5.9, 6.0, 6.0 m.

Caulerpa geminata Harv. (**Ca.g.**): Rhizomatous algae with short axes bearing paired, ovoid ramuli. Length 3cm. Depths 0.6, 4.0, 4.0, 4.5, 4.5 m.

Ulva sp. (**U.sp.**): Membranaceous plant with wide thallus. Length 18 cm. Depths 0.1, 0.4, 0.6, 0.9, 1.4 m.

Cladophora feredayi Harv. (**C.fe.**): Densely tufted algae with very fine terminal branches. Length 17 cm. Depths 1.0,1.2, 1.2, 1.3, 1.4 m.

Phaeophyta

Zonaria turneriana J. Ag. (**Z.t.**): Compact plant with flattened fronds approximately 12 mm wide. Length 13 cm. Depths 0.6, 1.0, 1.6, 4.2, 4.5 m. Photograph shown in Fig. 11.

Zonaria sp. (**Z.sp.**): Compact plant with twisted, flattened fronds approximately 4 mm wide. Possibly a different growth form of the preceding species. Length 15 cm. Depths 1.0, 1.2, 1.2, 1.4, 2.7 m.

Halopteris pseudospicata Sauv. (**H.p.**): Densely tufted plant with fine axes. Length 15 cm. Depths 0.7, 0.9, 1.0, 1.1, 1.2 m.

Ecklonia radiata (C. Ag.) (fronds **E.r.f.**, holdfasts **E.r.h.**): Kelp with single, short, erect stipe and broad foliose blade. Length 78 cm. Depths 1.4, 1.4, 1.5, 1.5, 1.9 m.

Table I (Cont.).

Hormosira banksii (Turn.) Dec. (H.b.): Thallus comprised of chains of large, bead-like segments. Length 26 cm. Depths 0.0, 0.2, 0.4, 0.4, 0.6 m.

Carpoglossum confluens (R. Br. ex Turn.) Kuetz. (C.co.): Thallus comprised of chains of flat, 2 cm wide, basally constricted segments. Length 61 cm. Depths 3.1, 3.2, 3.3, 3.7, 3.7 m.

Seirococcus axillaris (R. Br. ex Turn.) Grev. (S.a.): Algae with flat, distichously branched fronds and axillary rows of thin filament-like receptacles. Legth 62 cm. Depths 1.0, 1.4, 1.6, 1.7, 2.2 m.

Acrocarpia paniculata (Turn.) Aresch. (A.p.): Densely structured algae with thin, tristichous branches arising from main axis. Length 62 cm. Depths 0.9, 1.2, 1.2, 1.9, 1.9 m.

Cystophora retroflexa (Labill.) J. Ag. (C.r.): Vesiculate plant with long openly, branched primary and secondary axes. Length 103 cm. Depths 1.4, 1.6, 1.9, 2.7, 4.5 m. Photograph shown in Fig. 11.

Cystophora moniliformis (Esper) Wom. & Niz. (C.m.): Elongate algae with 1 cm wide primary axis and thin lateral branches. Length 67 cm. Depths 1.0, 1.2, 1.2, 1.4, 1.6 m.

Cystophora torulosa (R. Br. ex Turn.) J. Ag. (C.to.): Stout algae with primary axis along substrate bearing short secondary axes with elongate, club-shaped receptacles. Length 21 cm. Depths 0.0, 0.0, 0.0, 0.1, 0.2 m.

Caulocystis cephalornithos (Labill.) Aresch. (C.ce.): Vesiculate algae bearing radiating branches from stout main axis. Length 103 cm. Depths 0.4, 1.2, 4.2, 4.5, 4.5 m. Photograph shown in Fig. 11.

Table I (Cont.).

Sargassum decipiens (R. Br. ex Turn.) J. Ag. (S.d.): Thallus with 5 mm wide, flattened stem and many thin vegetative and reproductive branches. Length 42 cm. Depths 1.0, 1.2, 1.2, 1.4, 1.9 m.

Sargassum verruculosum (Mert.) C. Ag. (S.v.): Vesiculate algae with 4 mm wide basal "leaves" and thin, elongate branches. Length 42 cm. Depths 1.0, 1.2, 1.6, 2.7, 4.2 m. Photograph shown in Fig. 11.

Sargassum bracteolosum J. Ag. (S.b.): Vesiculate algae with wide basal and reproductive branches. Length 113 cm. Depths 0.6, 1.4, 1.7, 2.7, 4.2 m. Photograph shown in Fig. 11.

ostracods and mites) were grouped together and counted, and their abundances were included in faunal size structure determinations. These animals were not included in other analyses, however, because of taxonomic difficulties in assigning these animals to reliable species groups.

Some inaccurate designations of species groups still may have arisen among species with low abundances included in this study because of the undescribed nature of much of the fauna. However, these species contributed little to the faunistic analyses and any error introduced in this way should be relatively minor.

2.3.3 Algal Structure

Measurements of a variety of physical characteristics were made on each of the collected plants as follows:

Wet Weight (WW): Algal weight after excess water was removed by shaking (measured in grams).

Dry Weight (DW): Algal weight after drying for 48 hours at 84°C (measured in grams).

Epiphytic Weight (EW): Dry weight (after drying as above) of associated filamentous epiphytes (measured in grams).

Surface Area (SA): Estimated algal surface area (measured in cm^2). Preliminary experiments with indirect methods of determining surface area (Wieser, 1951; Harrod & Hall, 1962; Hicks, 1977) proved unsuccessful, and a mathematical derivation was used. The surface area to weight ratios of small pieces of algae were determined from their weight and the surface area of a theoretical

figure of the same size and geometric shape. The surface areas of the major component shapes of each plant were then calculated from these ratios. The total algal surface area was considered to be the sum of the different components of the plant.

Maximum Length (ML): Length from the holdfast to the distal tip of the plant (measured in cm).

Maximum Width (MW): Maximum width of the primary axis (measured in cm).

Maximum Width of the Final Branch (FW): Maximum distance across the widest final ramulus (measured in cm).

Maximum Depth of the Final Branch (FD): Maximum depth of the thickest final ramulus (measured in cm).

Degree of Branching (DB): The order of the primary axis. This was determined by analogy with stream classification (Horton, 1945). The final branches were classed first order and whenever two axes of the same order joined then the order of the resultant axis was increased by one.

Surface area, wet weight and dry weight were calculated after the removal of epiphytes.

2.3.4 Artificial Substrata.

Artificial habitats were randomly placed at the study site at depths of three to four metres six weeks before the sampling of natural algae. Each consisted of a paving brick (22x5x10 cm^3), an attached two metre line buoyed by a cork float, and three artificial algae which were joined to the line on the top surface of the brick and at 0.5 and 1.5 metres above the brick. Five replicate habitats were used for each of five differently shaped artificial algae prepared as follows:

(1) Filamentous long: 52 strands of 20 cm long monofilament fishing line (0.6 mm diameter).

(2) Filamentous short: 104 strands of 10 cm long nylon line (0.6 mm diameter).

(3) Flat long: 10 sheets of 1x10 cm^2 nylon cloth.

(4) Flat medium: 3 sheets of 3.3x10 cm^2 nylon cloth.

(5) Flat short: 6 sheets of 3.3x5 cm^2 nylon cloth.

Nylon sheets were stapled together at one end and nylon filaments were bound at the base with twine. All substrata had approximately the same surface area (200 cm^2).

The artificial algae were collected and treated in the same way as natural substrata during the major algal sampling programme.

2.3.5 Faunal Analyses

Plants were initially compared by calculating the faunistic similarity (S) between each pair of plants:

$$S = 1 - 1/2 \sum_{i=1}^{I} |p_{mi} - p_{ni}|$$

where p_{mi} and p_{ni} represent the proportional abundances of animal species i on plant m and plant n, and the total number of animals collected during the study was T.

This index is independent of the total animal abundance on each plant, which depends largely on algal weight, and varies from 0 (no species in common) to 1 (100% similarity of species and abundances).

Hierarchical cluster analysis (centroid linkage) was employed on the table of similarities to investigate whether phytal faunas showed consistent groupings with depth or within species of algae. This was further tested by extracting the more important dimensions within the similarity matrix using principal coordinate analysis and seeking correlations between these major dimensions and the values of the physical variables (i.e. the elements of algal shape and depth).

Relationships between the common animal species and the physical variables were assessed by setting up 2x2 contingency tables with animal presence or absence as one variable and the physical variable greater than (+) or less than (-) its median as the other. The null hypothesis that there was no association between the presence of an animal species and the physical variable being significantly ($p<0.01$) above or below its median was tested using χ^2 .

2.3.6 Size Analyses

The homogeneity of the size classes discriminated by the sieves was estimated by measuring the wet weight of a large number of individuals of different shaped species, and then determining the amount of overlap between the weights of animals retained by different sieve sizes. Animals were weighed on a microbalance after being placed on filter paper for 10 minutes at 20°C. The weight overlap was measured by calculating upper (U_{ij}) and lower (L_{ij}) weight bounds for each animal species i and sieve size j, and determining the proportion of animals on each sieve which fell outside these bounds.

$$U_{ij} = 1/2(\overline{\log x_{ij}} + \overline{\log x_{ij+1}}) \text{ and } L_{ij} = 1/2(\overline{\log x_{ij}} + \overline{\log x_{ij-1}})$$

where $\overline{\log x_{ij}}$ is the mean $\log_{10}$ weight of animal species i retained by sieve size j. Note that $U_{ij} = L_{ij+1}$, and that sieve size 1 refers to sieve size 0.5 mm, sieve size 2 refers to sieve size 0.72 mm, etc. Sieves with only one weight bound (e.g. the 0.5 mm sieve) were considered one-tailed and the proportion falling outside the bound doubled accordingly.

The size structure of the fauna of each plant was assessed by relating the proportional abundances of the animals in each of the seven sieve sizes

with the proportional abundances of the total fauna for each sieve size:

$$G_{jm} = P_{jm} / P_{jT}$$

where G_{jm} is a size index for sieve size j and plant m,

$$P_{jm} = T_{jm} / T_m,$$

$$P_{jT} = T_j / T,$$

and T_{jm} is the number of animals on sieve size j from plant m,

T_m is the total number of animals collected from plant m,

T_j is the total number of animals retained by sieve size j,

T is the total number of animals.

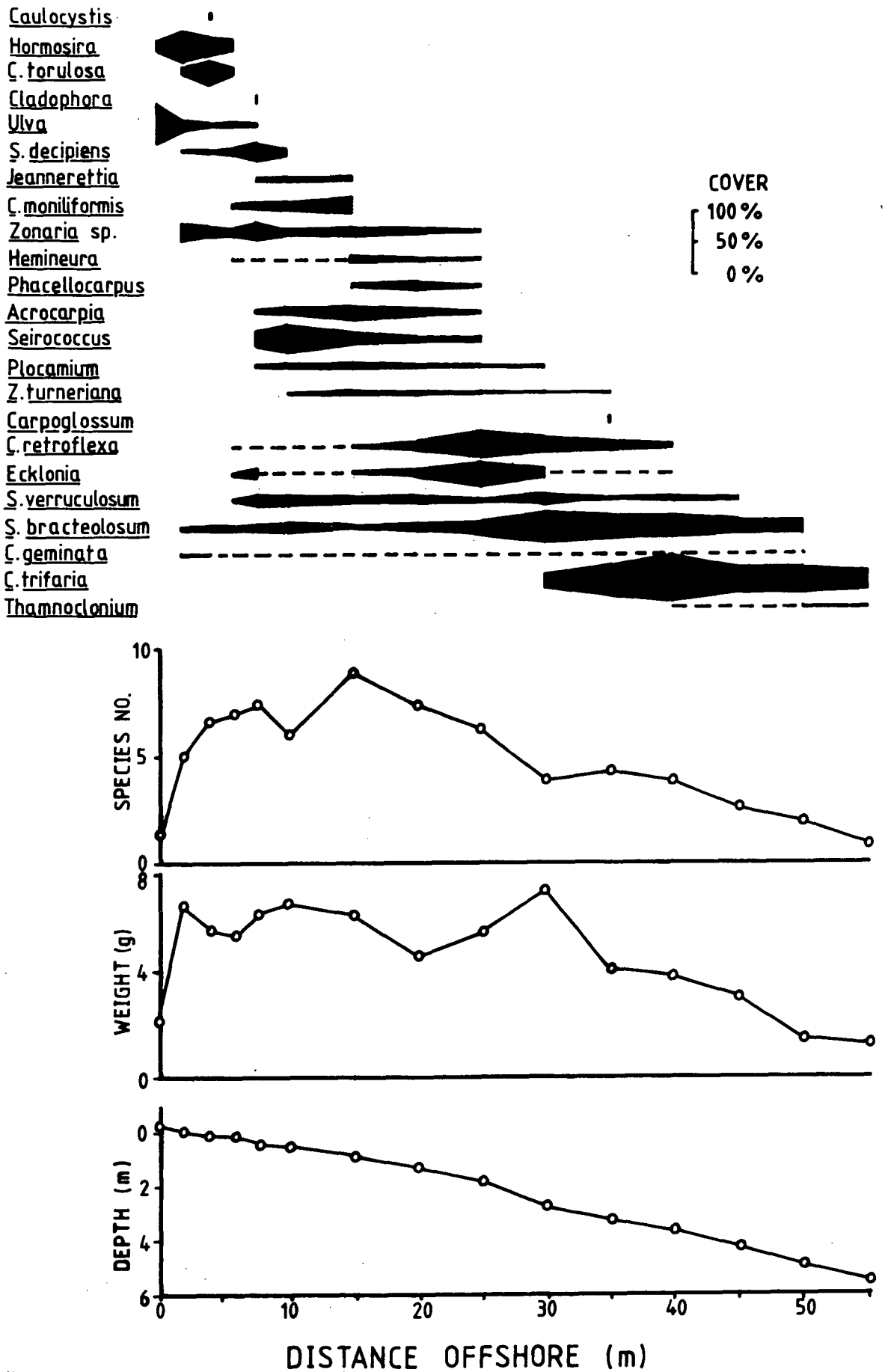
In order to allow mean size indices for each algal species to be presented in graphical form with equal weighting from each of the five replicates, the seven size indices (G_j) for each alga were expressed as percentages of the maximum size index for that alga ($(G_{jm}/\max G_m) \times 100$). The mean value of this size index was then calculated (as $\bar{G}$) from the five replicate algae for each of the seven size classes.

2.4 RESULTS

2.4.1 Vegetation

Hormosira banksii, Cystophora torulosa and Ulva lactuca dominated the algal assemblage near low water mark (Fig. 2). These algae grow to moderate lengths but lie close to the substratum, thereby ameliorating the effects of wave action. A diverse, structurally complex association of algae was present in the upper sublittoral zone (0.3 to 2.0 metres depth). The macro-algae within this zone ranged from elongate, vesiculate (Cystophora retroflexa,

Fig. 2. Profiles showing the depth gradient, wet weight of algae per square metre of substratum, and the number of algal species per $0.25m^2$ quadrat. Kite diagrams show the percent coverage of individual algal species; dashed lines indicate that the species was not sampled from intermediate depths.


Caulocystis
Hormosira
C. torulosa
Cladophora
Ulva
S. decipiens
Jeannerettia
C. moniliformis
Zonaria sp.
Hemineura
Phacellocarpus
Acrocarpia
Seirococcus
Plocamium
Z. turneriana
Carpoglossum
C. retroflexa
Ecklonia
S. verruculosum
S. bracteolosum
C. geminata
C. trifaria
Thamnoclonium
COVER
100 %
50 %
0 %
SPECIES NO.
WEIGHT (g)
DEPTH (m)
DISTANCE OFFSHORE (m)

Sargassum bracteolosum, Sargassum verruculosum) and non-vesiculate forms (Cystophora moniliformis, Jeannerettia lobata, Acrocarpia paniculata, Sargassum decipiens, Seirococcus axillaris, Ecklonia radiata) to relatively short species (Zonaria turneriana, Zonaria sp., Plocamium angustum, Phacellocarpus labillardieri). The deeper water assemblage (2.0 to 5.0 metres) had a two-tiered structure comprising openly branched, vesiculate C. retroflexa, S. bracteolosum and S. verruculosum rising above a carpet of the rhizomatous Caulerpa trifaria and Caulerpa geminata. The erect algae became very sparse with depth and at the edge of the reef only C. trifaria, Thamnoclonium clariferum and sponges were present. Occasional rhizomes of C. trifaria and the seagrass Heterozostera tasmanica (Mart. ex Aschers) den Hartog occurred on the sand below the reef.

Algal biomass remained fairly constant from 0 to 2.6 metres depth, but declined quickly beyond 2.6 metres. Species density of algae reached a peak at 1.0 metre depth.

2.4.2 Faunal Composition

The fauna was dominated numerically by amphipods but polychaetes, isopods, molluscs, pycnogonids and tanaids were also common (Table II). A list of the most abundant animal species is given in Table III and a full listing of species and abundances in Appendix 3.

Table II. Abundances and number of species of major animal groups.

Animal Group	Number of Species	Total Abundance
Gammaridean Amphipoda	70	22262
Caprellid Amphipoda	5	7772
Tanaidacea	6	918
Sphaeromatid Isopoda	6	530
Asellote Isopoda	11	520
Anthurid Isopoda	4	49
Gnathiid Isopoda	1	32
Idotheid Isopoda	1	24
Cumacea	2	22
Mysidacea	1	9
Caridea	4	28
Anomura	1	1
Brachyura	5	17
Insecta	1	28
Pycnogonida	4	221
Chaetognatha	2	9
Anthozoa	1	18
Platyhelminthes	4	38
Polychaeta	51	3559
Oligochaeta	3	33
Nemertea	9	96
Gastropoda	26	531
Amphineura	1	2
Holothuroidea	3	13
Echinoidea	1	4
Ophiuroidea	1	34
Asteroidea	2	32
Pisces	4	24
Total	230	36826

Table III. The abundances of the more common animal species and the significant ($p<0.01$) associations between presence and the physical variables depth (DE), wet weight (WW), dry weight (DW), epiphytic weight (EW), surface area (SA), maximum length (ML), degree of branching (DB), final depth (FD) and final width (FW). Positive association is indicated by +, negative by -.

Species	Association	Abundance	Species	Association	Abundance
Caprella danilevskii(Czerniavski)	DE-,SA+,BR+	7046	Gabophlias olono Barnard		53
Hyale ?loorea Barnard	DE-	4189	Paleanotus sp.		52
Mesoproboloides cruxlorraina Moore	DE-,EW+,SA+,BR+	2255	Austrodecus cf tubiferum Stock		51
Podocerus sp.1	ML+	1977	Gitanopsis sp.1		51
Tethygeneia sp.3	DE-,DW+	1834	Syllidae B		50
Hyale kandari Barnard	DE-	1476	Ampithoe sp.1		50
Tethygeneia sp.2	DE-,SA+	1314	Lembos sp.2		50
Tethygeneia sp.1	DE+	1231	Cymadusa sp.3		49
Paradexamine churinga Barnard		1098	Amphoroidea angustata Baker		48
?Micronereis sp.	EW+	1049	Paratanais ignotus Chilton		47
Paratanais sp.	WW+,DW+,EW+,ML+,FD+	827	Harmothoe sp.	DE+	45
Calliopidae A	WW+,DW+,SA+	783	Phasianotrochus eximinius (Perry)		44
Ampithoe sp.2	WW+,DW+,EW+,ML+,FD+	694	Aora maculata (Thomson)		44
Proto sp.	DE-,SA+,BR+,FD-	670	Bhawania sp.		43
Exogone verrugera (Claparede)		478	Macrozafra atkinsoni (Tenison Woods)		41

Table III (Cont.)

Species	Association	Abundance
Platynereis dumerillii (Audouin & Milne Edwards)	EW+,ML+	473
Cymadusa sp.1	FW+	442
Syllides longocirrata Oersted	EW+,ML+	431
Ampithoe sp.4	DE-,WW+	392
Syndexamine sp.1	DE-	376
Stenothoe sp.	DE-,ML+	368
Cymadusa sp.2		348
Eusiridae A	EW+	333
Brania rhopalophora (Ehlers)	DE+	317
Aora sp.1	WW+,DW+,EW+,ML+	307
Dynamenella sp.	BR+	293
Panoplea sp.	WW+,SA+	278
Bircenna sp.	WW+,DW+,EW+,ML+	263
Podocerus sp.2	WW+,DW+,EW+,SA+,ML+	254
Haplocheira barbimana (Thomson)		238
Raumahara judithae Moore	DW+	213
Ampithoe sp.3	WW+,DW+,EW+	202
Ausatelson ule Barnard	DE-,FD-	186
Callipallene sp.		165
Pionosyllis sp.		162
Munna sp.	DE+	158
Amphipholis squamata Delle Chiaje	ML-	34
Cerceis acuticaudata Haswell		34
Gnathia sp.		32
Tethygeneia sp.4		32
Tosia australis Gray		31
Diala monile (Adams)		31
Turbellaria A		30
Colanthura sp.	EW+	29
Polynoidae A	DE+	29
Caprella sp.		29
Pontomyia sp.		28
Oligochaete A		28
Lyssianassidae A	SA-	28
Caprella aequilibra Say		26
Apseudes sp.		26
Dentimitrella sp.		24
Paridotea ungulata Pallas		24
Raumahara sp.		22
Guernea sp.		20
Diala lauta Adams		20
Syllidae E		20

Table III (Cont.)

Species	Association	Abundance
Exogone gemmifera Pagenstecher	DE+	155
Hydrococcus brazieri (Tenison Woods)	DE+	147
Dynamenella parva Baker	EW+,ML+	141
Aora hircosa Myers & Moore	DE+	125
Eusiridae B		113
Microdiscula charopa Tate	BR+	101
Munnidae A		100
Gammaropsis sp.		97
Iphinotus sp.		95
Gammaridae A		80
Lembos sp.1	DE+,SA-	80
Jaeropsidae A		80
Antias sp.		72
Aora sp.3		67
Phyllodocidae A		66
Nemertean D	SA+	61
Iathrippa sp.		61
Schissurella rosea Hedley		55
Syllidae A		54
Corophium sp.		19
Anthozoa A		18
Nannastacus inflatus Hale		18
Phoxocephalidae A		18
Quasimodia sp.		16
Pisinna dubitabilis (Tate)		16
Parapandalus leptorhynchus Stimpson		15
Alabes parvulus (McCulloch)		15
Stenothoidae A		14
Colomastix sp.		14
Limnoria sp.		13
Jaeropsis sp.		12
Paradexamine sp.		11
Typosyllis sp.		11
Nemertean E		10
Leptochelia sp.		10
Syllidae B		10
Bedeva paivae (Crosse)		10

2.4.3 Faunal Groupings among Algae

Fig. 3 shows the hierarchy formed by grouping algae using faunistic similarity. Large subgroupings have been separated from the body of the dendrogram to facilitate the display of these results.

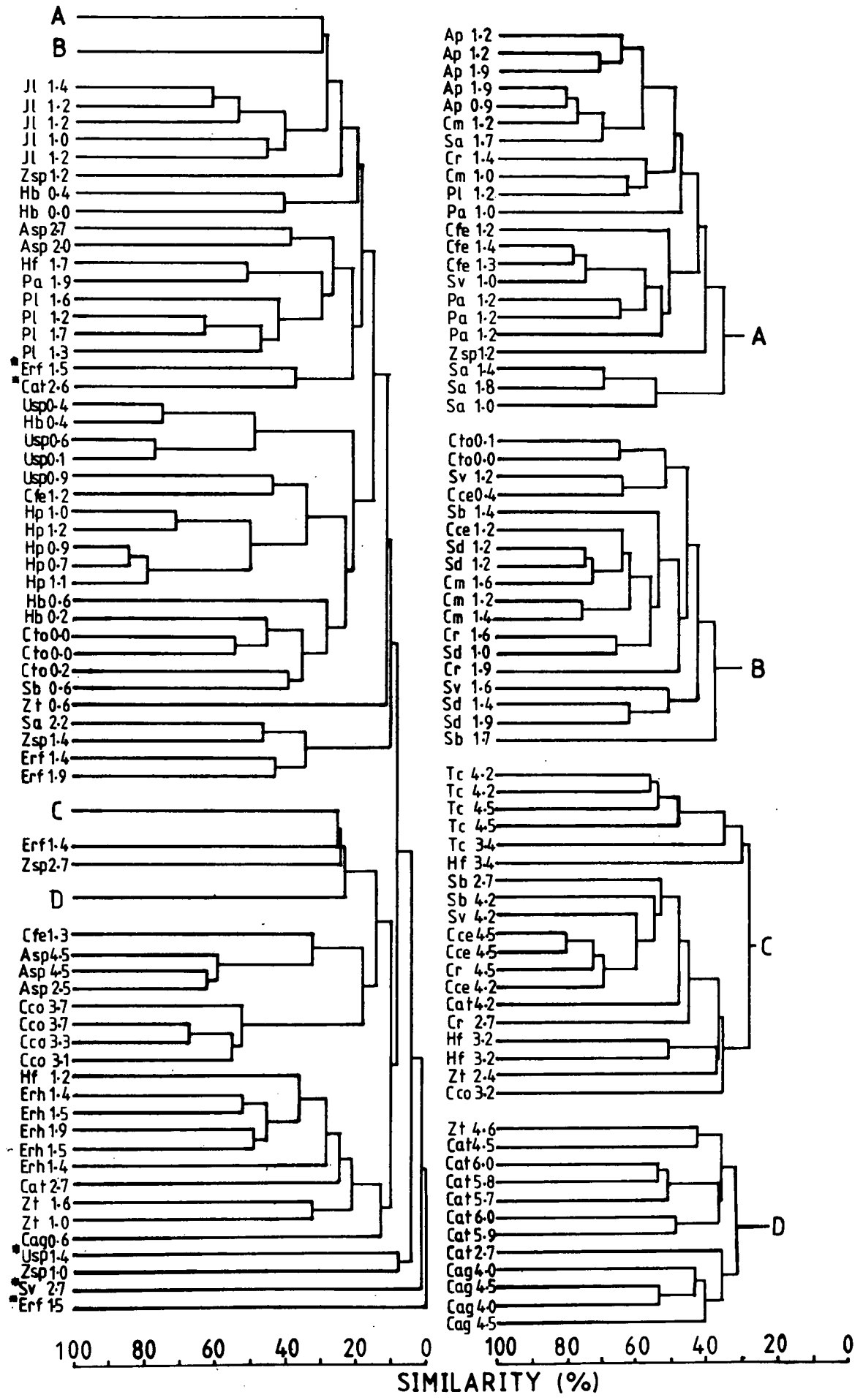
The algae show a complex pattern of relationships, with different species from similar depths generally grouping before the same species from different depths. Jeannerettia, Halopteris pseudospicata and Thamnoclonium each formed homogeneous groupings. These species have distinctive shapes and all replicates were collected from narrow depth ranges. Several other algae also showed strong clustering of replicates for the same reasons. These were Carpoglossum confluens, Phacellocarpus, Caulerpa geminata, C. trifaria and Ecklonia holdfasts.

Three depth zones (0 to 0.6 metres, 0.7 to 2.2 metres and 2.3 to 6.0 metres) can be distinguished from the dendrogram. Few samples were collected from near the boundaries of these depth zones so they should be treated with some caution. Nevertheless, only one plant (S. verruculosum from 1.2 metres, linking with elongate plants below 0.6 metres) showed greater than 50% similarity to algae outside its depth zone. The three animal zones corresponded closely to the three algal assemblages deduced from Fig. 2.

Within a depth zone, elongate algae with thin branches cluster together, as do compact algae. For example, all algae separated as subgroup B in Fig. 3 are elongate algae belonging to the genera Sargassum, Cystophora or Caulocystis.

Principal coordinate analysis also highlighted the greater response shown by animal species to depth rather than to algal shape. The first principal coordinate accounted for only 11% of the total variance while the

Fig. 3. Classification of algae by faunistic similarity. The depth (in metres) and abbreviation of the algal species (see Table I) are given for each algal sample. Samples indicated by asterisks were poorly classified as they contained 10 or less individuals.


A
B
Jl 1·4
Jl 1·2
Jl 1·2
Jl 1·0
Jl 1·2
Zsp 1·2
Hb 0·4
Hb 0·0
Asp 2·7
Asp 2·0
Hf 1·7
Pa 1·9
Pl 1·6
Pl 1·2
Pl 1·7
Pl 1·3
Erf 1·5
Cat 2·6
Usp 0·4
Hb 0·4
Usp 0·6
Usp 0·1
Usp 0·9
Cfe 1·2
Hp 1·0
Hp 1·2
Hp 0·9
Hp 0·7
Hp 1·1
Hb 0·6
Hb 0·2
Cto 0·0
Cto 0·0
Cto 0·2
Sb 0·6
Zt 0·6
Sa 2·2
Zsp 1·4
Erf 1·4
Erf 1·9
C
Erf 1·4
Zsp 2·7
D
Cfe 1·3
Asp 4·5
Asp 4·5
Asp 2·5
Cco 3·7
Cco 3·7
Cco 3·3
Cco 3·1
Hf 1·2
Erh 1·4
Erh 1·5
Erh 1·9
Erh 1·5
Erh 1·4
Cat 2·7
Zt 1·6
Zt 1·0
Cag 0·6
Usp 1·4
Zsp 1·0
Sv 2·7
Erf 1·5
Ap 1·2
Ap 1·2
Ap 1·9
Ap 1·9
Ap 0·9
Cm 1·2
Sa 1·7
Cr 1·4
Cm 1·0
Pl 1·2
Pa 1·0
Cfe 1·2
Cfe 1·4
Cfe 1·3
Sv 1·0
Pa 1·2
Pa 1·2
Pa 1·2
Zsp 1·2
Sa 1·4
Sa 1·8
Sa 1·0
A
Cto 0·1
Cto 0·0
Sv 1·2
Cce 0·4
Sb 1·4
Cce 1·2
Sd 1·2
Sd 1·2
Cm 1·6
Cm 1·2
Cm 1·4
Cr 1·6
Sd 1·0
Cr 1·9
Sv 1·6
Sd 1·4
Sd 1·9
Sb 1·7
B
Tc 4·2
Tc 4·2
Tc 4·5
Tc 4·5
Tc 3·4
Hf 3·4
Sb 2·7
Sb 4·2
Sv 4·2
Cce 4·5
Cce 4·5
Cr 4·5
Cce 4·2
Cat 4·2
Cr 2·7
Hf 3·2
Hf 3·2
Zt 2·4
Cco 3·2
C
Zt 4·6
Cat 4·5
Cat 6·0
Cat 5·8
Cat 5·7
Cat 6·0
Cat 5·9
Cat 2·7
Cag 4·0
Cag 4·5
Cag 4·0
Cag 4·5
D
100 80 60 40 20 0
100 80 60 40 20 0
SIMILARITY (%)

second, third and fourth axes accounted for 6%, 5% and 4%, respectively. Because of the large size of the similarity matrix (135x135), however, these low figures were still possibly indicative of an association between an underlying variable and the differences in abundance of animals between plants. The correlation coefficients between the first four principal coordinates and the physical variables (Table IV) indicate that the first coordinate is very strongly related to depth ($r=-0.74$). A simplified depth variable, coded for the three depth zones deduced from cluster analysis, shows a significant correlation with both the first ($r=-0.63$) and second ($r=0.47$) coordinate axes. The scattergram of coordinate axis 1 versus axis 2 would thus be expected to show separation of algal faunas with depth zone (Fig. 4). Intermediate and deep zones are seen to be relatively distinct but considerable overlap occurs between shallow and intermediate depth zones.

The only major correlation between any of the first four coordinate axes and elements of algal shape was between the degree of branching and the first axis ($r=0.43$).

2.4.4 Animal Species/Physical Variable Relationships

Animal species whose presence was significantly ($p<0.01$) associated with physical variables are listed in Table III. There is a considerable degree of inter-correlation between the physical variables (Table V), indicating that many associations were not the result of direct relationships. The surprising association of the algal-boring amphipod Bircenna with epiphytic weight, for example, is due to the common occurrence of Bircenna among large, perennial fucoid algae which generally also have heavy epiphytic loads.

Table IV. Correlation coefficients between principal coordinates and physical variables. DE' is depth variable coded for the three depth zones deduced from cluster analysis.

Physical Variable	Latent Variable 1	2	3	4
DE	-0.74	-0.37	-0.19	-0.09
WW	0.04	-0.18	-0.12	0.08
DW	0.02	-0.18	-0.09	0.09
EW	0.24	0.00	-0.17	-0.05
SA	0.22	-0.16	-0.00	0.22
ML	-0.06	-0.13	-0.30	0.01
MW	-0.10	0.04	0.10	0.08
DB	0.43	-0.31	0.03	0.29
FD	-0.12	0.21	0.02	-0.19
FW	-0.09	0.16	0.08	0.15
DE'	-0.63	-0.47	-0.19	-0.02

Fig. 4. Scattergram showing the distribution of the samples along the first two coordinate axes. Samples are coded for the three depth zones deduced from cluster analysis. Those with less than 10 individuals have not been included.

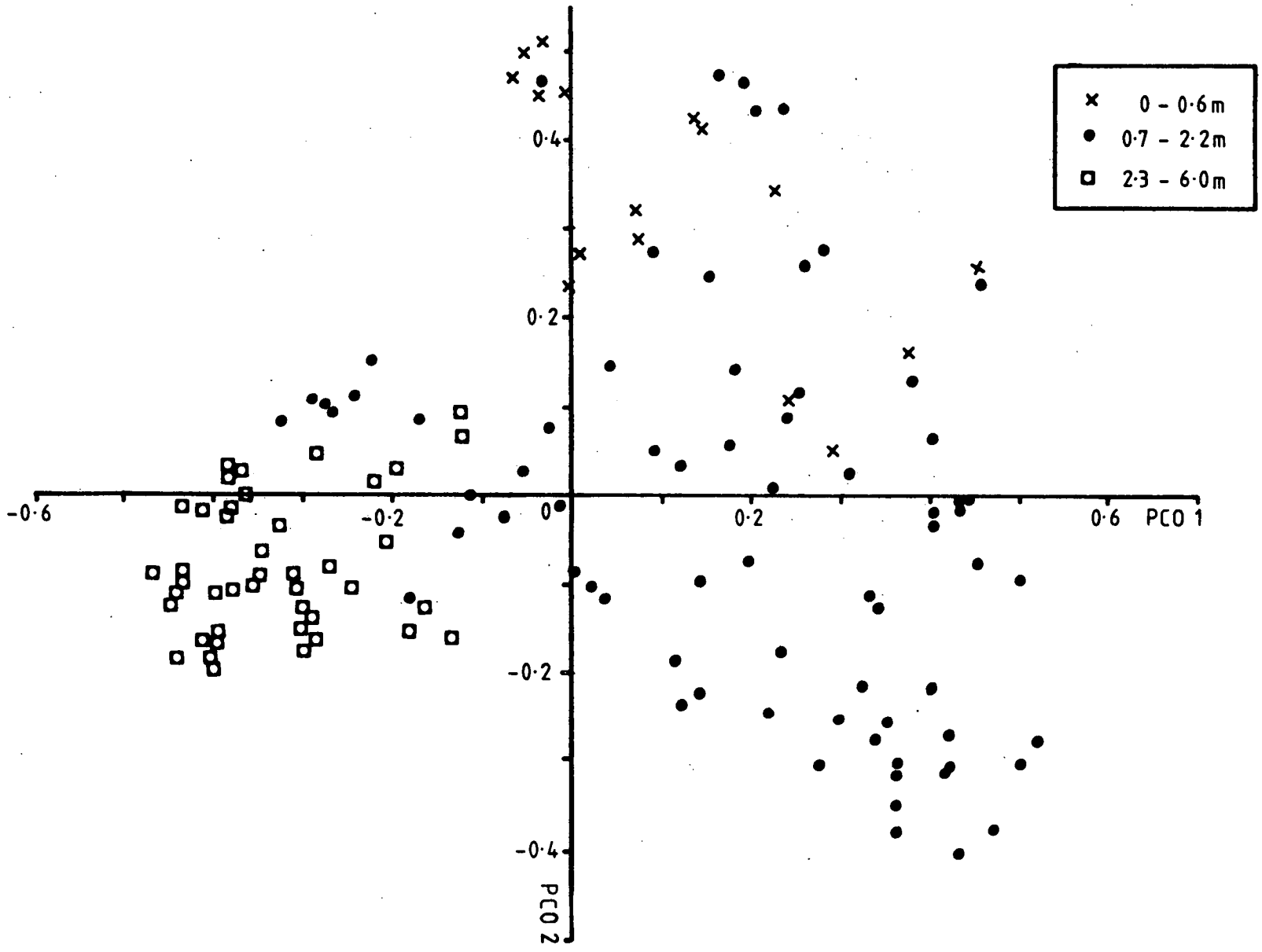

0 - 0·6m
0·7 - 2·2m
2·3 - 6·0m
0·4
0·2
-0·2
-0·4
-0·6
0
0·2
0·6
PCO 1
PCO 2

Table V. Correlation coefficients between physical variables. DE' is a simple coded version of variable DE.

DE	1.00										
WW	-0.05	1.00									
DW	-0.02	0.97	1.00								
EW	-0.17	0.25	0.31	1.00							
SA	-0.15	0.67	0.64	0.18	1.00						
ML	0.07	0.26	0.24	0.03	0.11	1.00					
MW	-0.13	0.58	0.50	0.00	0.42	0.09	1.00				
DB	-0.21	-0.14	-0.12	-0.03	0.20	0.00	-0.37	1.00			
FD	-0.11	0.36	0.31	0.02	0.07	0.09	0.40	-0.32	1.00		
FW	-0.15	0.41	0.35	-0.03	0.26	0.04	0.80	-0.46	0.24	1.00	
DE'	0.88	-0.04	-0.02	-0.19	-0.07	0.15	-0.11	-0.02	-0.25	-0.17	1.00
	DE	WW	DW	EW	SA	ML	MW	DB	FD	FW	DE'

The physical variable associated with the distributions of the greatest number of animal species was depth DE (20 species), followed by epiphytic weight EW (13 species), wet weight WW (11 species), surface area SA and maximum length ML (10 species each), dry weight DW (8 species), degree of branching DB (5 species), final depth FD (4 species) and final width FW (1 species).

Most of the amphipods which showed variation in abundance with depth preferred shallow water (11 of 14 species), while other species with restricted depth ranges were all found in deep water (6 species). The structure of the phytal assemblage at different depths showed considerable differences as a result of these associations (Table VI). Communities in less than two metres of water were dominated by amphipods, among which were the most abundant species collected in the study (Table III). Below this depth the community had fewer amphipods but considerable numbers of polychaetes, molluscs and asellote isopods.

2.4.5 Animal Abundance/Physical Variable Relationships

In order to determine which physical variables affected the abundances of the major animal groups (amphipods, isopods, polychaetes and molluscs), stepped multiple regression analysis was performed between log animal abundance and transformed physical variables.

Preliminary inspection of scattergrams indicated that all variables other than depth (DE) and degree of branching (DB) needed logarithmic transformation. Furthermore, log final width (LFW) responded in a quadratic fashion to log animal abundance. Hence LFW^2 was also introduced into the regression, and LFW and LFW^2 were stepped together into the equation.

Table VI. Total and proportional abundances of the major animal groups at different depths.

Animal Group	Depth					
	0-0.9m	1.0-1.9m	2.0-2.9m	3.0-3.9m	4.0-4.9m	5.0-6.0m
Gammaridean Amphipoda	6681 (67.2%)	13005 (59.9%)	836 (74.3%)	276 (53.8%)	1379 (46.9%)	57 (41.3%)
Caprellid Amphipoda	1805 (18.2%)	5926 (26.8%)	29 (2.6%)	1 (0.2%)	10 (0.3%)	1 (0.7%)
Tanaidacea	307 (3.1%)	479 (2.2%)	7 (0.6%)	4 (0.8%)	118 (4.0%)	2 (1.4%)
Sphaeromatid Isopoda	98 (1.0%)	389 (1.8%)	14 (1.2%)	2 (0.4%)	27 (0.9%)	0
Asellote Isopoda	64 (0.6%)	109 (0.5%)	15 (1.3%)	106 (20.7%)	207 (7.0%)	10 (7.2%)
Gastropoda	87 (0.9%)	221 (1.0%)	34 (3.0%)	11 (2.1%)	155 (5.2%)	20 (14.5%)
Polychaeta	799 (8.0%)	1489 (6.7%)	166 (14.7%)	99 (19.3%)	960 (32.7%)	29 (21.0%)
Others	105 (1.1%)	463 (2.1%)	25 (2.2%)	14 (2.7%)	80 (2.7%)	19 (13.8%)
Total	9946	22081	1126	513	2936	138

Table VII shows the variables which accounted for more than 2% of the variance of log abundance, together with the regression equations relating these variables and the percentages of the variance explained.

It is likely that the low variance accounted for by the physical variables in the abundances of polychaetes, isopods and molluscs (29.1%, 33.2% and 36.8% respectively) was due to different responses to physical factors by the many dominant species within each group. However, the most abundant amphipods seem largely to be influenced by physical variables in the same way, resulting in a large proportion of log amphipod abundance being explained (61.7%). Much of the variance of log total abundance is accounted for by the amphipods which comprised 81% of all animals collected.

The abundances of all groups of animals respond to log wet weight (LWW) and LFW but show little agreement in their relationships to other variables. The coefficient of LWW in the regression equation approximates 1 in all groups other than molluscs, indicating that the relationship between wet weight and abundance is approximately linear if other variables remain constant. The parabolic relationship between log abundance and LFW is discussed later as it is closely related to the size distribution of animals.

Amphipod abundance showed a considerable decline with depth. The expected number of amphipods on a plant at 4 metres depth is 25% of the number on a similarly shaped plant at low water mark. Conversely, isopod and mollusc numbers increased with depth. Isopods and molluscs were also more abundant on algae with short maximum lengths, presumably because they prefer habitats close to the rock substratum. A further factor greatly affecting isopod abundance was the degree of branching of plants.

Table VII. Results of the stepped multiple regression analysis. Variables explaining more than 2% of the variance of log animal abundance (LNO) are given with the regression equation and the cumulative percentages of the variance explained for each of the major animal groups.

Total Animals

Variable	R^2
$LFW+LFW^2$	28.7
LWW	45.8
DE	50.0
LFD	52.2
LEW	54.2
Others	57.1

$LNO = 4.38 - 0.67LFW - 0.139LFW^2 + 0.86LWW - 0.192DE - 0.38LFD - 0.21LEW$

Amphipoda

Variables	R^2
$LFW+LFW^2$	23.0
LWW	42.2
DE	53.7
LFD	58.2
Others	61.7

$LNO = -0.45 - 0.72LFW - 0.14LFW^2 + 1.00LWW - 0.34DE - 0.49LFD$

Table VII (Cont.).

Isopoda

Variables	R^2
BR	7.5
LML	14.4
$LFW+LFW^2$	20.7
LSA	26.0
LWW	30.8
DE	33.2
LDW	35.3
Others	36.8

$LNO = -0.73 + 0.177BR - 0.42LML - 0.34LFW - 0.145LFW^2 - 0.067LSA + 0.97LWW + 0.13DE - 0.33LDW$

Polychaeta

Variables	R^2
LWW	12.2
$LFW+LFW^2$	19.9
LDW	23.7
Others	29.1

$LNO = -0.87 + 1.25LWW - 0.32LFW - 0.087LFW^2 - 0.72LDW$

Mollusca

Variables	R^2
$LFW+LFW^2$	12.6
LML	21.9
LWW	27.7
DE	30.5
Others	33.2

$LNO = -0.35 - 0.34LFW^2 - 0.072LFW - 0.39LML + 0.64LWW + 0.10DE$

One surprising aspect of the regression analysis was that none of the four groups of animals responded greatly to log epiphytic weight, while total abundance showed a slight negative trend with this variable. As epiphytes were not included in calculations of wet weight, dry weight or surface area, it seems likely that few animals (>0.5 mm sieve size) were present among epiphytes.

2.4.6 Size Analyses

A considerable proportion of each size class of the chironomid Pontomyia and the polychaete Platynereis dumerilii was inaccurately classified using sieves to discriminate size classes (Table VIII). However, the percentage overlap between size classes of Pontomyia has been exaggerated as most chironomids were retained by the 0.5 mm sieve but these animals weighed only slightly less than the few animals caught by the mesh of the larger sieves. The log weight difference between sieves was much less than 0.45 (the expected figure if weight is assumed to increase approximately eight-fold with each doubling of length), with the result that the weight bounds for Pontomyia were calculated unrealistically close together and consequently the weights of many animals lay outside these bounds.

Sieve size proved to be a useful method for estimating the sizes of gammaridean amphipods and molluscs as there was little overlap in the size classes of these groups. The degree of flexion of preserved amphipods was relatively constant within species and did not greatly affect size classification.

Table VIII. Mean log10 weight of animals retained by different sieves and the weight overlap between sieves. Sample sizes given in parentheses.

	Sieve Size							
	4.0mm	2.8mm	2.0mm	1.4mm	1.0mm	0.72mm	0.5mm	Overlap
Amphipoda								
Paradexamine churinga				-0.61 (11)	-0.99 (20)	-1.16 (19)	-1.79 (19)	24%
Cymadusa sp.1		0.74 (4)	0.60 (6)	0.01 (37)	-0.73 (20)	-1.19 (19)	-1.60 (9)	27%
Tethygeneia sp.1				-0.05 (4)	-0.72 (20)	-1.09 (19)	-1.50 (13)	18%
Mysidacea								
Siriella sp.		0.38 (5)	0.29 (5)	-0.47 (13)	-0.73 (7)			40%
Insecta								
Pontomyia sp.				-0.68 (4)	-0.83 (8)	-0.87 (21)	-1.06 (20)	72%
Gastropoda								
Diala lauta			0.99 (6)	0.43 (51)	0.17 (20)	-0.43 (20)	-1.15 (5)	23%
Diala monile					0.21 (3)	-0.30 (9)	-0.79 (7)	0%
Haminoea maugeanensis Burns				0.10 (6)	0.16 (18)	-0.73 (16)	-1.29 (5)	29%
Polychaeta								
Platynereis dumerilii	1.06 (2)	-0.10 (3)	0.12 (2)	-0.29 (11)	-0.85 (20)	-1.33 (14)	-1.83 (13)	59%
Harmothoe sp.			0.07 (2)	-0.12 (8)	-0.73 (10)	-1.20 (5)	-1.84 (6)	26%

The size distribution of the phytal fauna was closely associated with plant shape (Fig. 5). Algae with wide thalli (Zonaria, Carpoglossum, Ulva, Jeannerettia and Hemineura) or densely compacted branches (Caulerpa geminata, Plocamium, Phacellocarpus and Ecklonia holdfasts) had proportionately greater numbers of large animals than other plant species. Algae with fine branches (notably Halopteris, Cladophora and Caulocystis) showed the opposite response, and had much greater abundances of small animals. The size distributions of animals on algae with intermediate sized branch widths (Thamnoclonium and Cystophora torulosa), or algae with markedly different sized axes (Sargassum decipiens, S. bracteolosum and S. verruculosum), were variable.

The widest-bladed algal species collected (Ecklonia) proved an exception to the general trend as the fronds showed the greatest number of animals at the 0.5 mm sieve size. This was due to the presence of dense swarms of harpacticoid copepods. Extensive sampling of Ecklonia fronds with sieves up to 10 cm mesh would probably show another peak of abundance at a very large sieve size, as echinoids and the large gastropod Turbo undulatus Solander were commonly present on Ecklonia, but rarely found among other algal species. It is likely that the curves of relative abundance for other algae may also prove to be polymodal. They generally appear unimodal in this study, however, because the meiofauna and microfauna were not investigated and only five replicates per species were collected.

Each of the four major animal groups was investigated for the presence of an algal shape/animal size response. Algal species with wide thalli (Zonaria, Carpoglossum, Ulva, Jeannerettia, Hemineura, Ecklonia fronds, Seirococcus and S. bracteolosum) were pooled together, as were algae with fine branches (Cladophora, Halopteris, Anotrichium, Caulocystis, Acrocarpia,

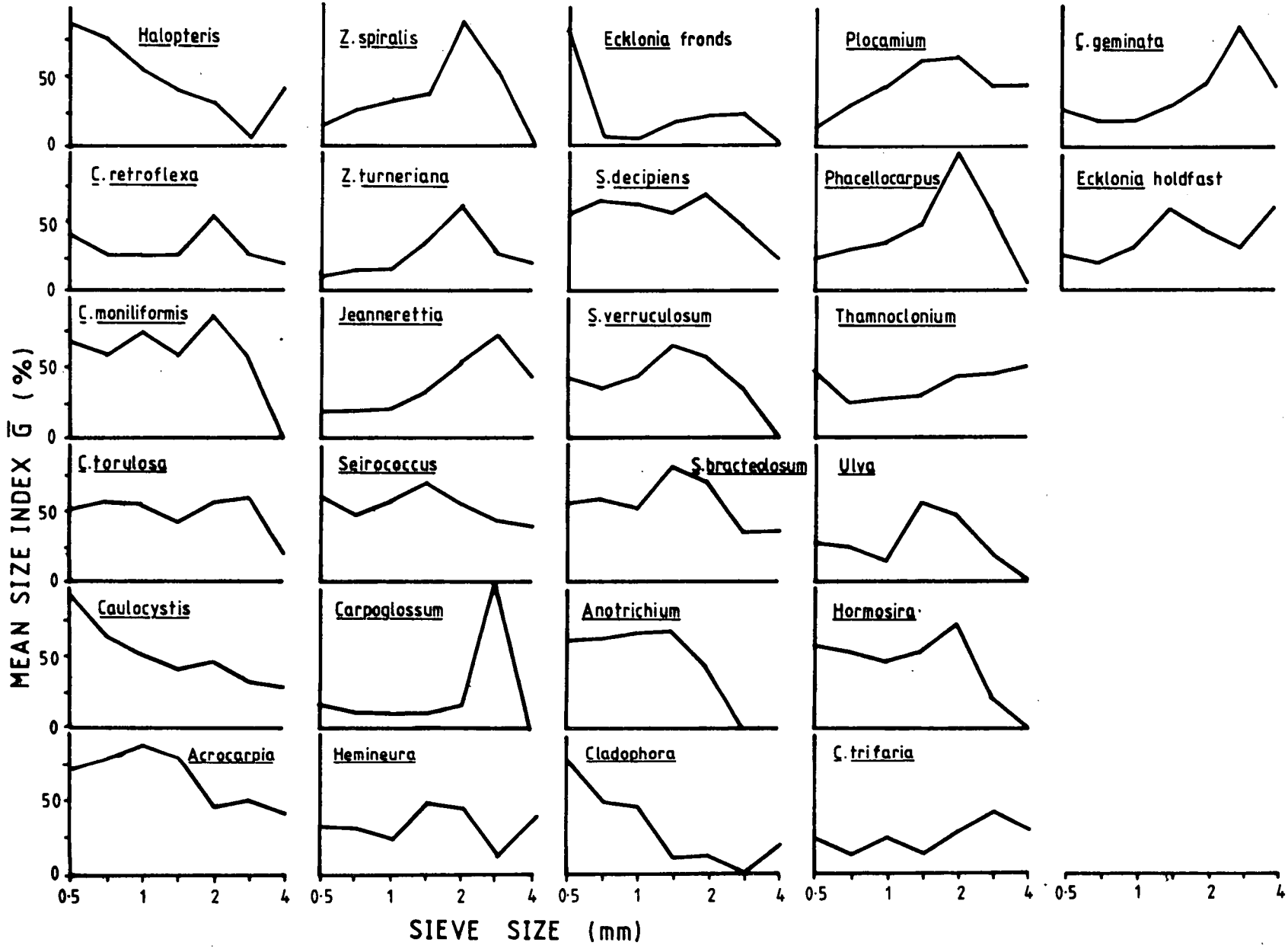


Fig. 5. Size structures of the faunas associated with different algal species.

S. verruculosum, S. decipiens, C. moniliformis and C. retroflexa), and the number of animals graphed as a proportion of the total abundance for each size class and animal group (Fig. 6).

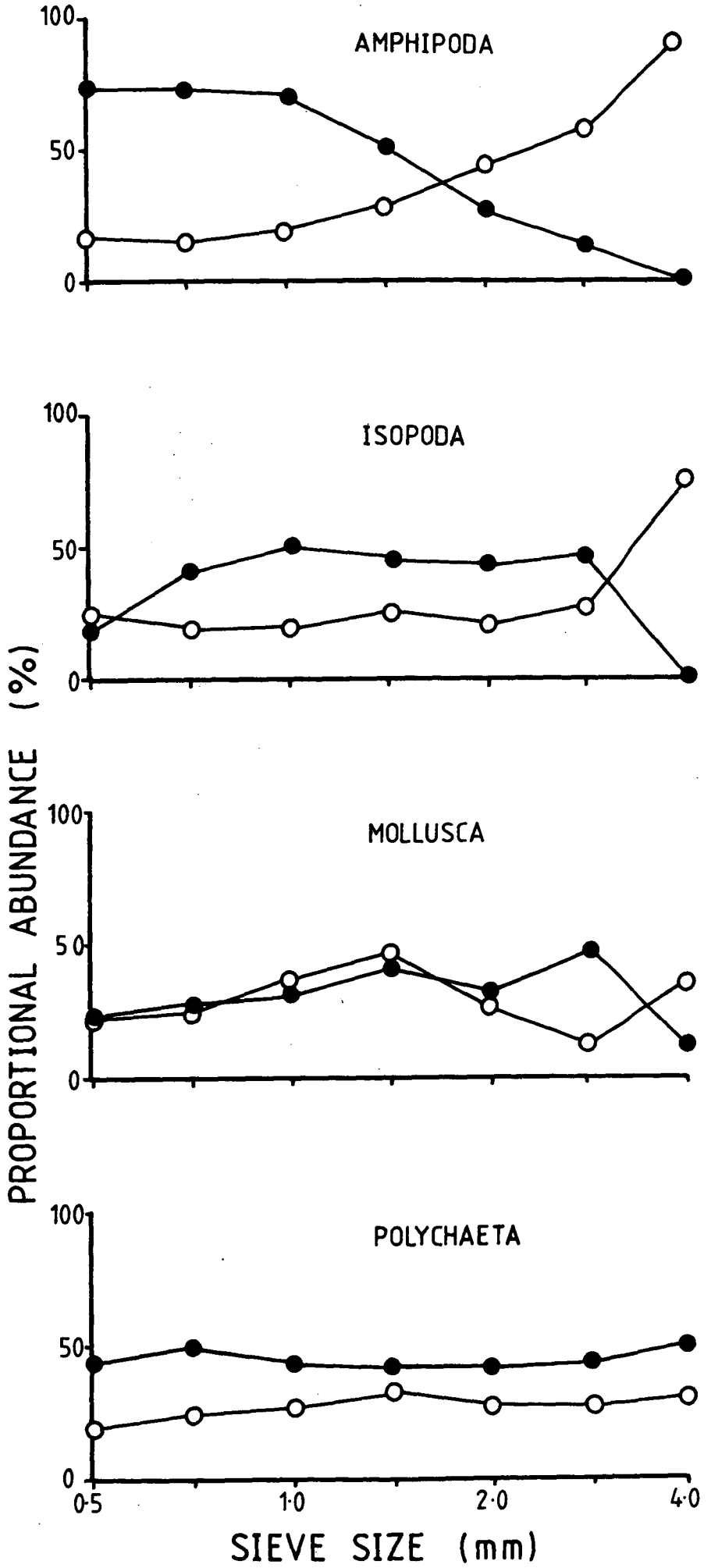
A very strong positive relationship emerged between amphipod size and the width of algal branches, while isopods and molluscs showed no clear relationship. A slight trend for widely-bladed algae to have proportionately greater numbers of large polychaetes also emerged as animals at 1.4 mm sieve size were proportionately twice as abundant as animals at 0.5 mm sieve size. This relationship, however, is probably confounded by the error in allocating polychaetes to size classes.

As the gammaridean amphipods dominated the total fauna and showed the strongest relationship with plant shape, the size structure of this group of animals was investigated in greater detail.

The size distributions of amphipods on different algal species (Fig. 7) showed similar trends to the size distributions of the total fauna, but they were much more clearly defined. C. retroflexa, C. moniliformis and Anotrichium have a predominance of small amphipods, a feature not readily apparent when the total fauna was investigated. The peaks of relative abundance for amphipods on the densely compacted algae Caulerpa geminata, Plocamium and Phacellocarpus are at smaller sizes than was evident for the total fauna because large isopods and molluscs were commonly found on these plants.

Log maximum width of final branch (LFW) provided a reasonable estimate of the degree of filamentation of algae. It showed a highly significant correlation with the sieve size at which the amphipods showed proportionately greatest abundance ($n=135$, $r=0.40$, $p<0.001$). This relationship is clearly seen by calculating, for each algal species, the mean of the sieve sizes at which amphipods showed greatest proportionate abundances, and regressing this

Fig. 6. Proportional abundances of the four major animal groups associated with finely-branched (closed circles) and wide-bladed (open circles) algae at different sieve sizes.


AMPHIPODA
ISOPODA
MOLLUSCA
POLYCHAETA
100
50
0
PROPORTIONAL ABUNDANCE (%)
0·5
1·0
2·0
4·0
SIEVE SIZE (mm)

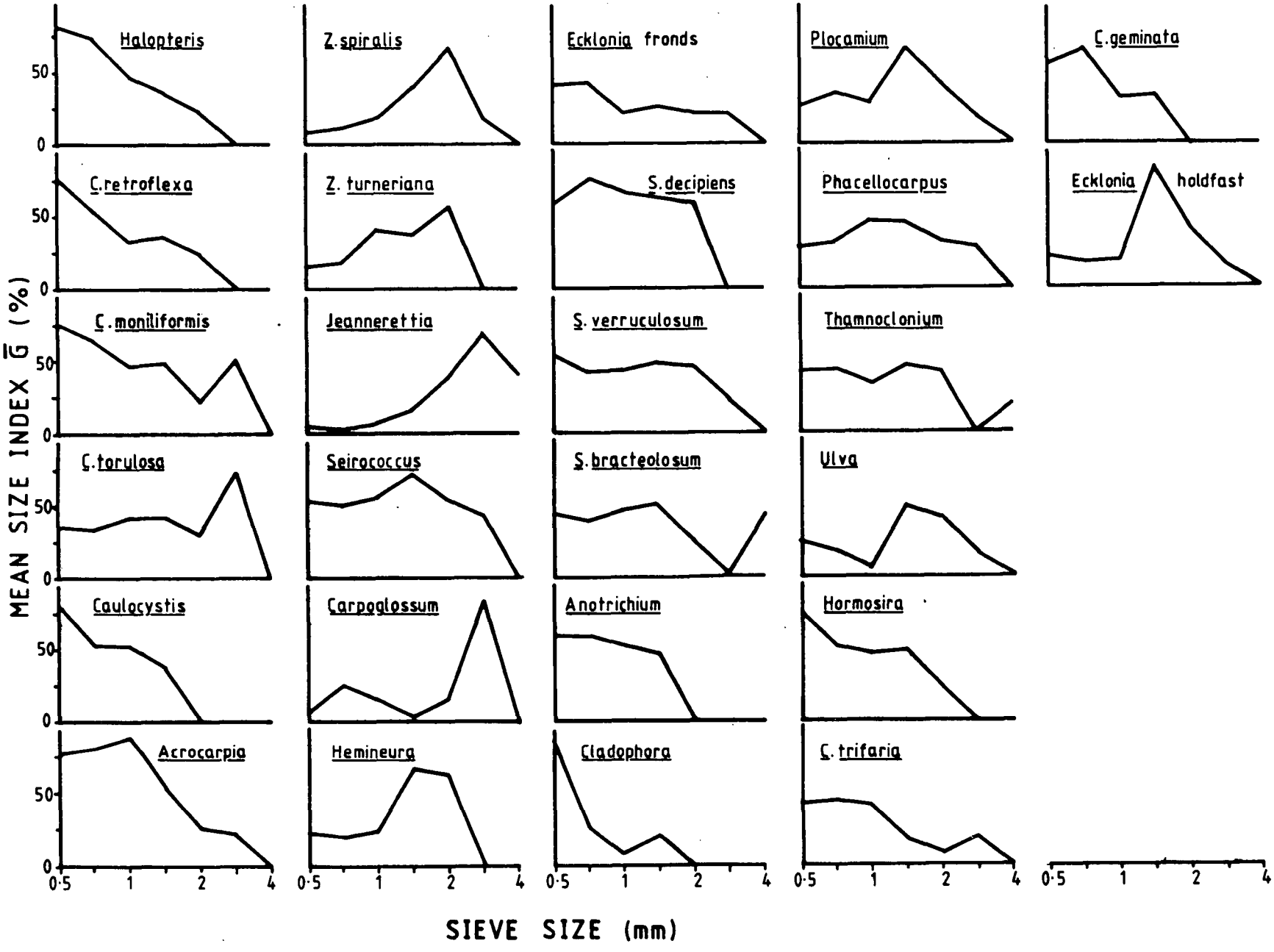


Fig. 7. Size structures of the amphipod faunas associated with different algal species.

number against mean LFW (Fig. 8, n=26, r=0.67, p<0.001). It is notable that the algae which deviate considerably below this regression line (Caulocystis, Ecklonia fronds, Hormosira and C. retroflexa) are elongate species with open branching patterns.

LFW and LFW^2 were shown earlier to explain the largest portion of the variance of log animal abundance. Multiple regression analysis between the log animal abundance of amphipods from different sized sieves and LFW, LFW^2 and LWW show that the relationships change greatly with amphipod size (Table IX). Algae with no amphipods present within a given sieve size were deleted from the calculation of the LFW/abundance relationship for that particular size class. If LWW is held constant, the maximum abundance of 0.5 mm sieve size animals is expected to occur on algae with branch widths of 0.1 mm, while the greatest numbers of 2.8 mm sieve size animals are present on algae with widths of 4.6 mm. Thus, the shape of the curve relating total numbers to LFW in this study is heavily biased by the dominance of 0.5 mm animals.

Intraspecific rather than interspecific processes result in the presence of large animals on wide-bladed algae. Fig. 9 gives size-frequency histograms for abundant gammaridean amphipods in the 0.7 to 2.2 metre depth zone on ten algal species which were widely distributed in that zone. All amphipod species showed preferences for particular algae but occurred on almost all plants. Consistent bias was evident with small individuals of almost all animal species being predominant on Cladophora, Halopteris, S. decipiens and C. moniliformis. Some larger animals occurred on the more densely compacted Acrocarpia, Phacellocarpus and Plocamium while the wide bladed algae Zonaria and Jeannerettia had many large animals. Seirococcus, however, did not have consistent size bias; it was dominated by juveniles of some animal species (Mesoproboloides cruxlorraina, Tethygeneia sp. 2) and large individuals of

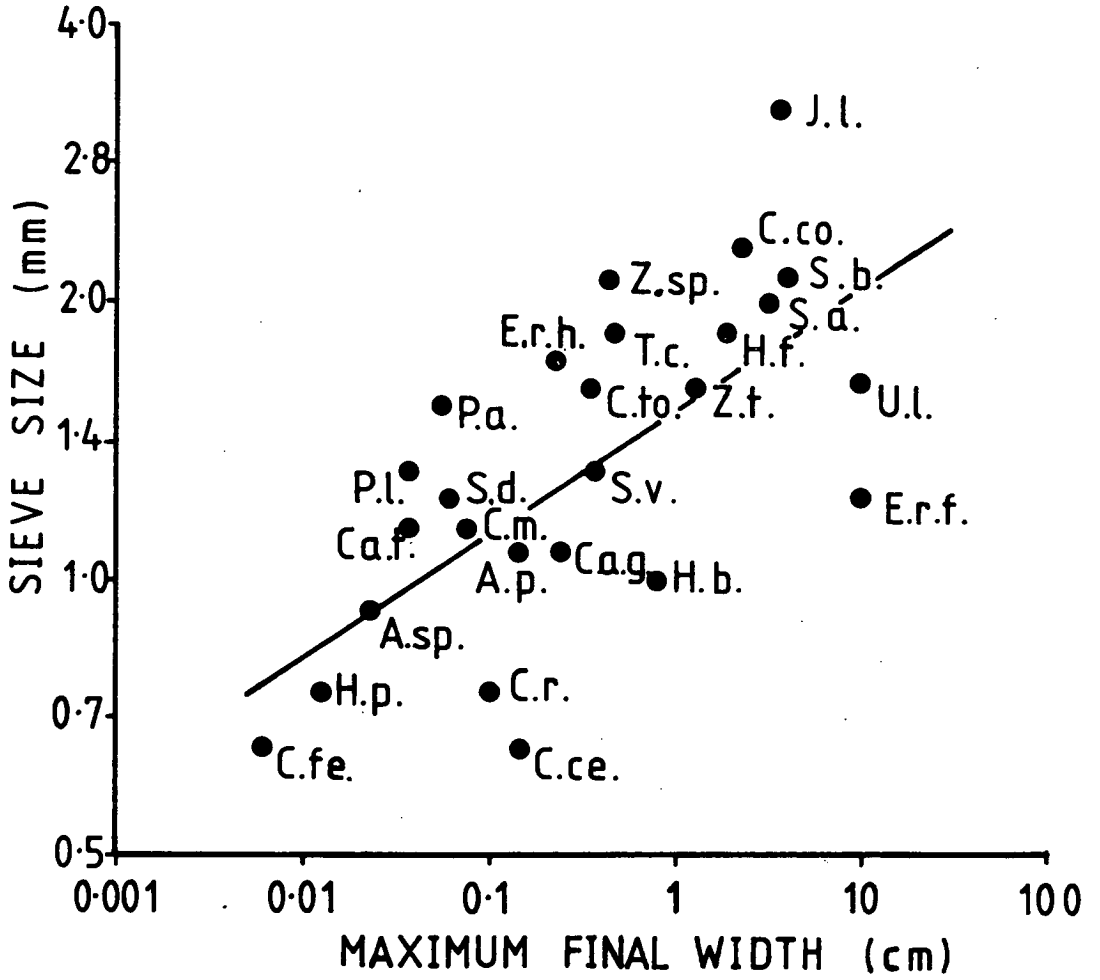


Fig. 8. Relationship between mean log maximum width of the final branch (LFW) and the mean sieve size at which amphipods reach greatest relative abundance. The linear regression of best fit (Y = 4.22 + 0.89X) has been plotted.

Table IX. Multiple regression equations relating log amphipod abundance (LNO) with LWW, LFW and LFW^2 for different sized sieves. The turning point indicates the LFW at which abundance is maximal.

Sieve Size (mm)	Equation	R^2	Turning Point
0.50	$LNO = 1.46 + 0.89LWW - 0.56LFW - 0.062LFW^2$	39.4	-4.49
0.72	$LNO = 0.64 + 0.94LWW - 0.69LFW - 0.109LFW^2$	46.6	-3.17
1.00	$LNO = 0.48 + 0.87LWW - 0.59LFW - 0.111LFW^2$	38.5	-2.64
1.40	$LNO = 0.92 + 0.53LWW - 0.40LFW - 0.072LFW^2$	28.0	-2.75
2.00	$LNO = 0.88 + 0.21LWW - 0.23LFW - 0.085LFW^2$	15.3	-1.34
2.80	$LNO = -0.66 + 0.45LWW - 0.134LFW - 0.088LFW^2$	34.2	-0.76
Total	$LNO = 1.59 + 0.74LWW - 0.56LFW - 0.083LFW^2$	41.8	-3.34

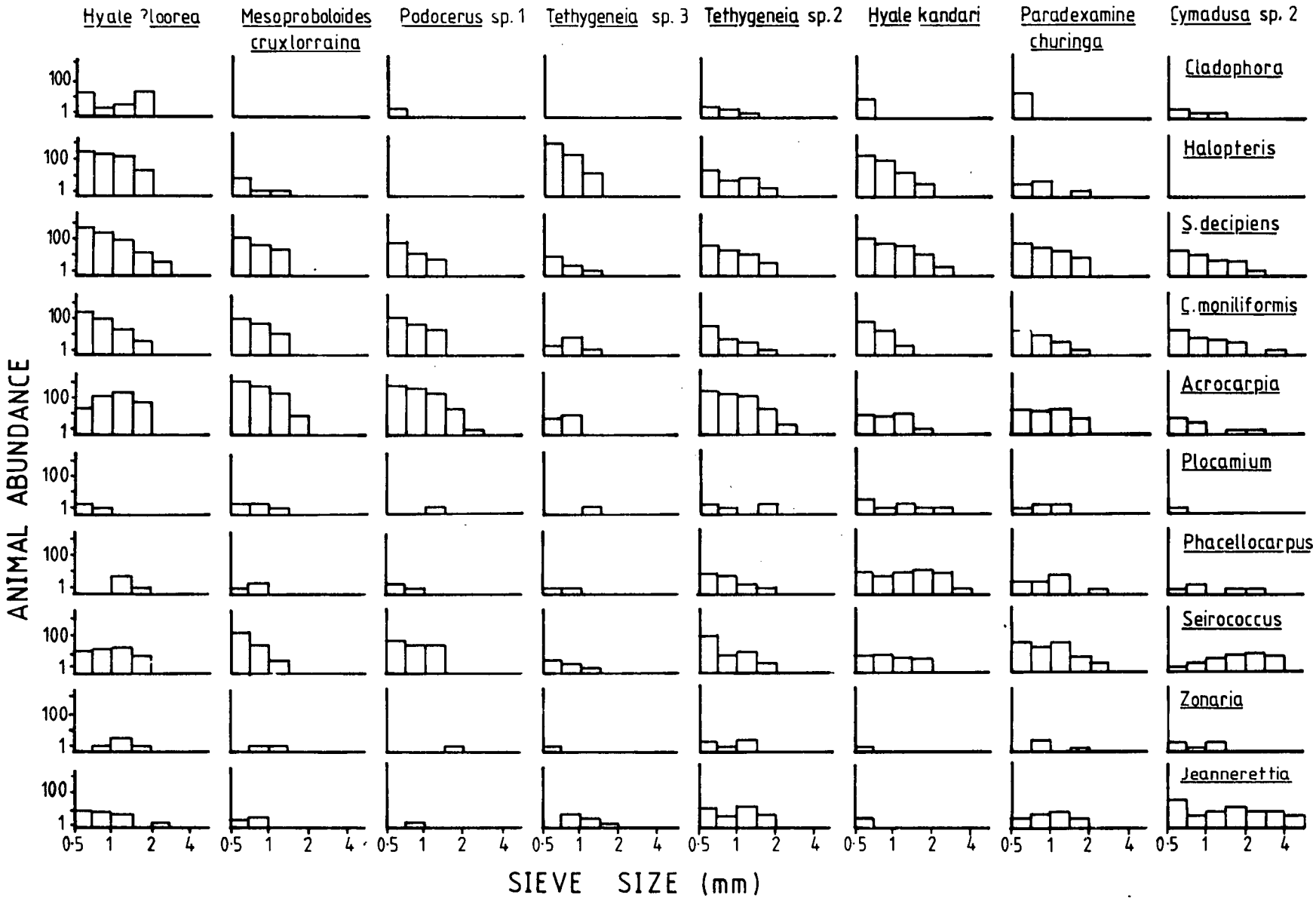


Fig. 9. Size-frequency histograms of eight abundant amphipod species (columns) associated with ten algal species (rows) collected in the 0.7-2.2 metre depth zone. Note log transformed axes.

others (Paradexamine churinga, Cymadusa sp. 2). This may be due to the two-fold structure of Seirococcus with small animals responding to the filament-like receptacles and large animals attracted to the wide thalli.

The χ^2 test for association between the presence of animal species and LFW (Table III) provides further confirmation of the lack of specificity between animal species and blade width as only one species was present significantly more times on wide-bladed than finely-bladed plants.

2.4.7 Artificial Substrata

Three artificial habitats (one short flat, one short filamentous and one long filamentous) could not be relocated during the sampling period and thus were excluded from analyses.

Artificial algae were poorly colonised by animals over the six week period. The average number of animals per substratum was approximately 25% of the number expected to occur on natural algae with similar size and shape collected from the same depth. A factor contributing to the low abundances may be the relative absence of detrital material and poor coverages of surfaces by diatoms, although some growth of filamentous epiphytic algae was noticeable, particularly on the uppermost substrata. The animals collected proved to be a representative cross-section of the phytal fauna in the 2.3 to 6.0 metre depth (Table X) zone with an exception being that gastropods were greatly under-represented.

Considerable differences existed between the size distributions of faunas on flat and filamentous artificial algae. The three flat algae and the two filamentous substrata were each pooled because of the low abundances of

Table X. Abundance of animal species collected on flat and filamentous artificial algae from different heights above the reef substratum.

Animal Species	Height			'Algal' Type	
	1.5m	0.5m	0m	Flat	Filamentous
Paradexamine churinga	9	5	2	15	1
Tethygeneia sp. 1	2	3	3	3	5
Aora hircosa	20	7	8	34	1
Cymadusa sp. 1	5		2	7	
Raumahara sp.			1		1
Haplocheira barbimana			1	1	
Hyale ?loorea		4	2	6	
Hyale kandari	1		1	2	
Cymadusa sp. 2	4			4	
Stenothoe sp.			1		1
Mesoproboloides cruxlorraina		1		1	
Tethygeneia sp. 3			2	2	
Gammaropsis sp.			1	1	
Caprella aequilibra			1		1
Caprella danilevskii	1	1		1	1
Gnathia sp.		1	2	2	1
Cerceis acuticaudata		1		1	
Dynamenella parva		2		1	1
Dynamenella sp.			6	6	
Munna sp.	1			1	
Munnidae A		2		2	
Antias sp.			2	2	
Neastacilla sp.			1		1
Brachyuran megalopa	1				1
Pontomyia sp.	1				1
Turbellarian A			1		1

Table X (Cont.).

Animal Species	Height			'Algal' Type	
	1.5m	0.5m	0m	Flat	Filamentous
Diala monile		1		1	
Hydrococcus brazieri		1	3	3	1
Diala translucida	1	1		1	1
Platynereis dumerilii	32	19	18	45	24
Syllides longocirrata	34	9	2	23	22
Polynoidae A	1		3	4	
Exogone gemmifera	1	3	10	8	6
Exogone verugera	3	5	5	8	5
Brania rhopalophora	2	2	6	6	4
Phyllodocidae A	1		1	1	1
Harmothoe sp.	3	2	1	6	
Bhawania sp.			3	2	1
Syllidae I			1	1	
Brania sp.	1			1	
Oligochaete A			1	1	
Nemertean D		2	4	6	

animals. Both habitat types showed similar densities of animals retained by the 0.5 mm sieve but much greater abundances of large animals were present on wide substrata (Fig 10a).

Equivalent numbers of small animals were present at the three different heights above the substratum (Fig. 10b). Larger animals (primarily Platynereis dumerilii and Aora hircosa), however, were more abundant at the +1.5 metre level. The polychaete Platynereis dominated the large animals, comprising 85% of the animals from filamentous substrata retained by sieves of 1 mm or larger, and 43% of similarly sized animals from flat substrata.

2.5 DISCUSSION

The choice between collecting qualitative or quantitative data is an important one for ecologists because of the great differences in labour costs between the two approaches (Watling et al, 1978). In a comparative study of holdfast faunas from different localities along the British coast, Moore (1974) found that little additional information was gained by collecting abundance rather than presence/absence data in samples of one algal species. However, faunal variation among plants within a single locality is certainly more subtle, with different species of algae lacking distinctive faunas but showing differences in the relative abundances of animals (Dahl, 1948; McKenzie & Moore, 1981).

Quantitative rather than qualitative differences were evident within a depth zone at Fancy Point, particularly between filamentously branched and flat thalloid algae. These differences were largely due to the intimate relationship between the size structure of plants (both natural and artificial) and associated animals.

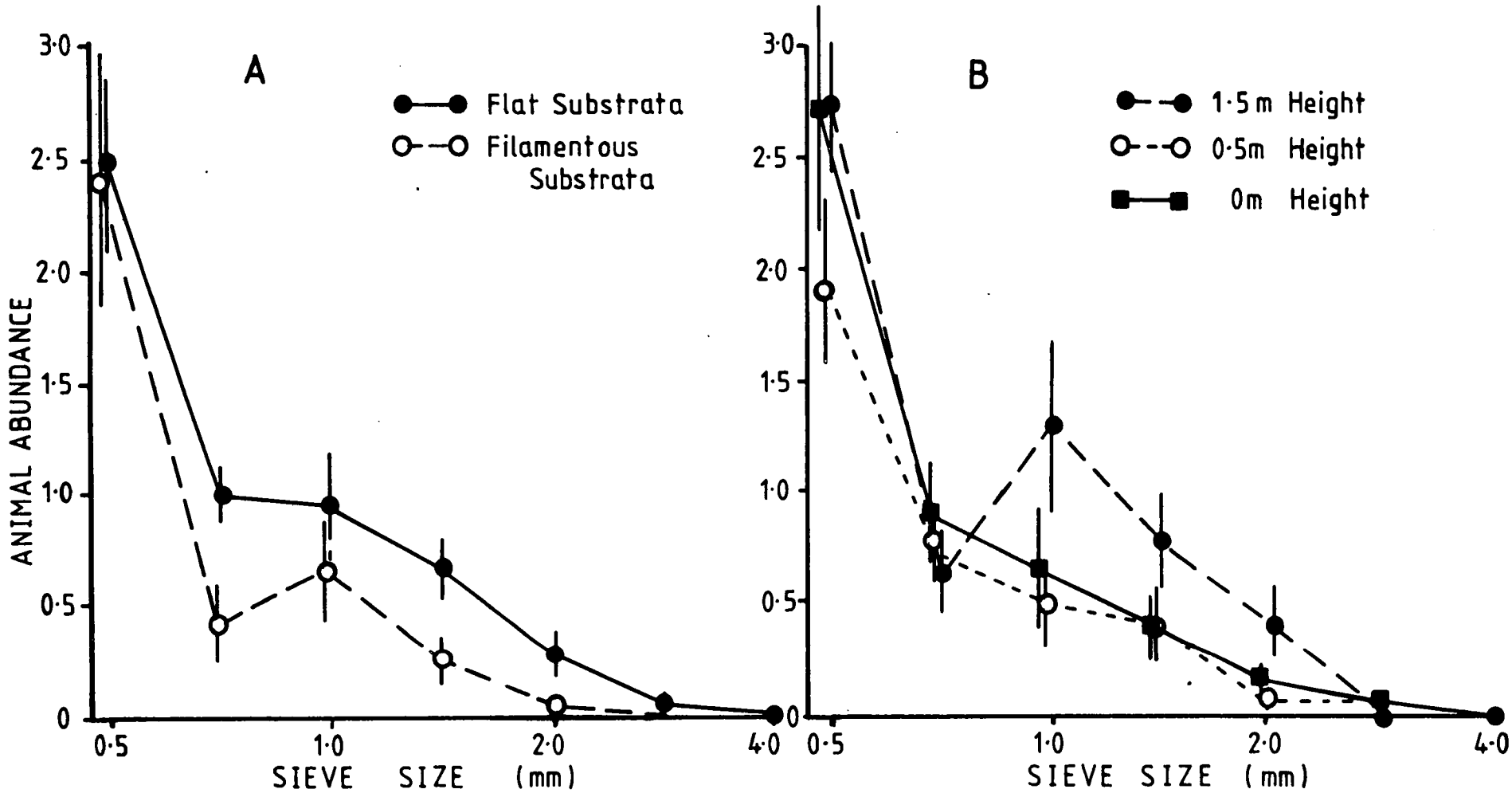


Fig. 10. Total abundances (± standard errors) of animals of different sieve sizes on artificial algae of different shape (A) and height above the reef surface (B).

It is unfortunate that the general nature of this relationship has not been recognised before, with the consequence that faunal size structure has been overlooked in most phytal studies. This is despite the considerable attention paid to the size of benthic organisms in soft substrata (Reish, 1959; Thiel, 1975), and the fact that all phytal sampling is constrained, by sorting restrictions, either to animals within predetermined size limits, or to animals belonging to taxonomic groups with limited size ranges. Nevertheless, several authors working on particular animal species associated with marine plants have noted a spatial separation of size classes with juveniles present on filamentous algae (Jansson & Matthieson, 1971; Wigham, 1975; Moore, 1977).

Whereas the size distributions of animals residing amongst rigid structures such as corals would be expected to reflect substratum shape (Sloan, 1982), the consistency of the size structures of amphipods associated with flexible algae in this study is surprising. It is likely that the algal shape/amphipod size relationship is mediated more by predation than energetic considerations, even though animals would presumably move more readily through gaps in the branching patterns than by continually pushing branches aside.

Few large amphipods of any species were found on long algae with fine open branches. Visual predators such as fish would be expected to locate and capture large animals readily within such a plant form. Furthermore, small animals which are present on wide-bladed algae may be preyed upon by larger animals also associated with the plant.

In the seagrass environment, which is directly comparable, it has been suggested that the intensity of fish predation is the main factor organising the amphipod community (Nelson, 1979a). The predation pressure exerted by fish

in seagrass beds has also been found to differ significantly between prey sizes, and in regions of differing seagrass density (Vince et al, 1976; Van Dolah, 1978; Stoner, 1979; Heck & Thoman, 1981).

The observed algal shape/animal size relationship can be explained by the random distribution of animals among algae, and the likelihood that the size selective predation of fish is hindered by wide-bladed or densely compacted algae. It could also arise indirectly by the evolution in phytal amphipods of algal preference or avoidance as a consequence of such factors as direct size selective predation or algal biochemical exudation.

The retention of animals on a series of sieves proved a practical method of separating size classes, although less accurate (especially with vermiform species) than the labour intensive method of measuring individual animals. Sieve size also provides a convenient way of equating the sizes of species with vastly different shapes, in the same way it is generally used for allocating arbitrary boundaries to the macrofauna, meiofauna etc.

The considerable changes in the phytal fauna with depth are probably related to differences in water movement. Suspension feeding amphipods have been found to be useful indicators of water flow in previous studies. Fenwick (1976) showed that ischyrocerid and caprellid amphipods dominated the fauna on Caulerpa brownii at an exposed site off New Zealand in depths of three to seven metres, while other organisms dominated the fauna in more sheltered waters. Dahl (1948) and Moore (1973b) found caprellids and ischyrocerids to be abundant on algae at exposed sites. Nagle (1968) also demonstrated that caprellids preferred waters with considerable wave action and strong currents. Moreover, caprellid amphipods associated with sponges were shown by Peattie & Hoare (1981) to reach maximal numbers in regions of considerable water movement.

A sharp decrease in the abundance of podocerid and caprellid amphipods occurs at predictable depths around Bruny Island (see Chapters 3 and 5). These animals are presumably filter feeders as they possess highly setose antennae (see Caine, 1974, 1977). They were poorly represented in sheltered bays at any depth, but comprised greater than 90% of the motile fauna on the exposed coast to 12 metres depth.

At Fancy Point, caprellids and podocerids dominated the fauna down to two metres depth, but were virtually absent below this level. This depth agrees closely with the primary dichotomy in the fauna deduced from multivariate analyses. Water movement probably differs significantly between the two zones, with turbulent flow providing a large suspension feeding niche in the upper zone and greater settling of particles in the lower zone allowing for increased numbers of detritivores.

Just as phytal animal species exhibited varying relationships with depth, there was little uniformity in the response of animal species to elements of algal structure. Animal abundances were approximately proportional to weight or surface area within an algal species, and to a lesser degree within algae of similar shape, but large variability was introduced if animal density was compared between algae of different shapes. Table XI shows that animal densities (total abundance/surface area) had relatively low variance within algal species but that density differed considerably between algal species.

The multiple regression equations given in Table IX indicate that animals retained on a 0.5 mm sieve were most abundant on plants with branch widths considerably less than their body sizes. These animals would be more likely to respond to individual branches than to total surface area. Larger amphipods (2.8 mm sieve size) had peaks of abundance on blades with widths

Table XI. Mean densities (numbers/cm^2x100) of major animal groups on algae in deep (2.3-6m) and shallow (0-2.2m) depth zones (± standard deviation).

Algal Species	All Animals		Amphipoda		Gastropoda		Isopoda		Polychaeta	
	Depth Zone									
	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep
Hemineura frondosa	3.71	8.42±3.70	2.09	3.26±1.21	0.06	0.21±0.18	0.52	1.88±1.99	0.66	2.65±1.69
Jeannerettia lobata		3.70±2.38		2.24±1.47		0.07±0.06		0.08±0.05		1.11±0.79
Plocamium angustum	7.45±3.19		5.35±1.74		0.25±0.25		1.23±1.61		0.48±0.37	
Phacellocarpus labillardieri	8.46±3.53		6.47±3.09		0.48±0.21		0.71±0.58		0.44±0.11	
Thamnoclonium clariferum		35.7±4.37		8.85±2.95		1.02±0.62		6.26±3.46		7.74±3.34
Anotrichium sp.	1.33	0.96±0.68	0.83	0.72±0.56	0	0.06±0.05	0	0.02±0.03	0.50	0.14±0.19)
Caulerpa trifaria		6.46±4.17		2.72±1.35		0.95±0.11		0.53±0.48		1.37±1.14
Caulerpa geminata	81.9	25.2±10.6	28.9	3.97±3.12	14.4	3.11±1.71	12.8	8.00±5.66	14.4	7.66±3.49
Ulva lactuca	1.79±1.14		1.55±0.92		0		0.01±0.02		0.17±0.32	
Cladophora feredayi	0.65±0.30		0.51±0.28		0.01±0.01		0		0.12±0.17	
Zonaria turneriana	10.8±7.46	6.67	5.70±3.62	5.05	0.87±0.76	0.48	3.70±3.67	1.17	0.45±0.52	7.65
Zonaria sp.	8.76±4.96	7.79	6.80±4.06	4.69	0.32±0.27	1.10	0.50±0.17	0.28	0.91±0.90	1.72
Halopteris pseudospicata	9.92±3.69		9.44±3.61		0.05±0.03		0.02±0.02		0.32±0.11	
Hormosira banksii	5.48±3.39		4.10±3.90		0.15±0.17		0.55±0.34		0.40±0.38	
Carpoglossum confluens		2.41±1.95		2.02±1.85		0		0.11±0.24		0.26±0.39

Table XI (Cont.).

Algal Species	All Animals		Amphipoda		Gastropoda		Isopoda		Polychaeta	
	Depth Zone									
	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep
Seirococcus axillaris	5.94±2.34		5.19±2.25		0.10±0.08		0.06±0.01		0.48±0.26	
Acrocarpia paniculata	69.0±56.7		63.6±53.4		0.35±0.38		1.05±0.56		2.14±1.59	
Cystophora retroflexa	11.5±10.9	6.81	8.63±7.53	3.57	0.04±0.07	0.17	0.63±0.36	0.36	1.75±2.70	2.24
Cystophora moniliformis	29.2±12.9		26.0±12.1		0.03±0.04		0.36±0.08		1.16±0.72	
Cystophora torulosa	75.8±43.5		56.7±37.6		1.61±1.91		0.97±0.72		11.9±7.91	
Caulocystis cephalornithos	44.8	20.2±3.84	32.9	10.2±2.09	0.10	0.22±0.21	0.73	0.68±0.18	5.30	8.16±1.74
Sargassum decipiens	37.6±24.6		31.9±23.5		0.13±0.19		0.70±0.45		3.32±1.80	
Sargassum verruculosum	14.1±9.2	8.07	12.1±9.3	6.29	0.05±0.08	0.08	0.32±0.13	0.70	1.07±1.32	0.68
Sargassum bracteolosum	14.5±12.5	4.03	10.7±8.62	1.74	0.13±0.10	0.21	1.49±2.01	0.24	0.80±0.55	1.70
Ecklonia radiata fronds	0.12±0.06		0.05±0.03		0.01±0.01		0.01±0.01		0.02±0.01	
Ecklonia radiata holdfast	35.3±23.6		16.1±11.7		0.20±0.33		4.83±2.72		10.5±7.81	

approximately 4.7 mm wide and may possibly distribute themselves with reference to surface area. The large amphipod Erichthonius braziliensis was found by Connell (1963) to use behavioural mechanisms to space populations evenly over a flat surface. Furthermore, after a series of substratum selection experiments, Stoner (1980) concluded that the amphipods Cymadusa compta and Grandidierella bonnieroides were equally distributed among different shaped seagrasses with similar surface areas, but that a third species, Melita elongata, showed a much greater preference for filamentous algae than seagrasses. He did not discuss the sizes of these three species.

Some macrofaunal animals may thus be responsive to surface area among widely bladed plants but, in heterogeneous environments, others choose from a variety of structural characteristics. It appears that multivariate methods are needed to describe the significant structure of algae rather than simply to relate animals to a universal variable such as surface area or the absorption coefficient as suggested by Wieser (1951).

CHAPTER 3: SEASONALITY OF PLANTS AND ANIMALS

3.1 INTRODUCTION

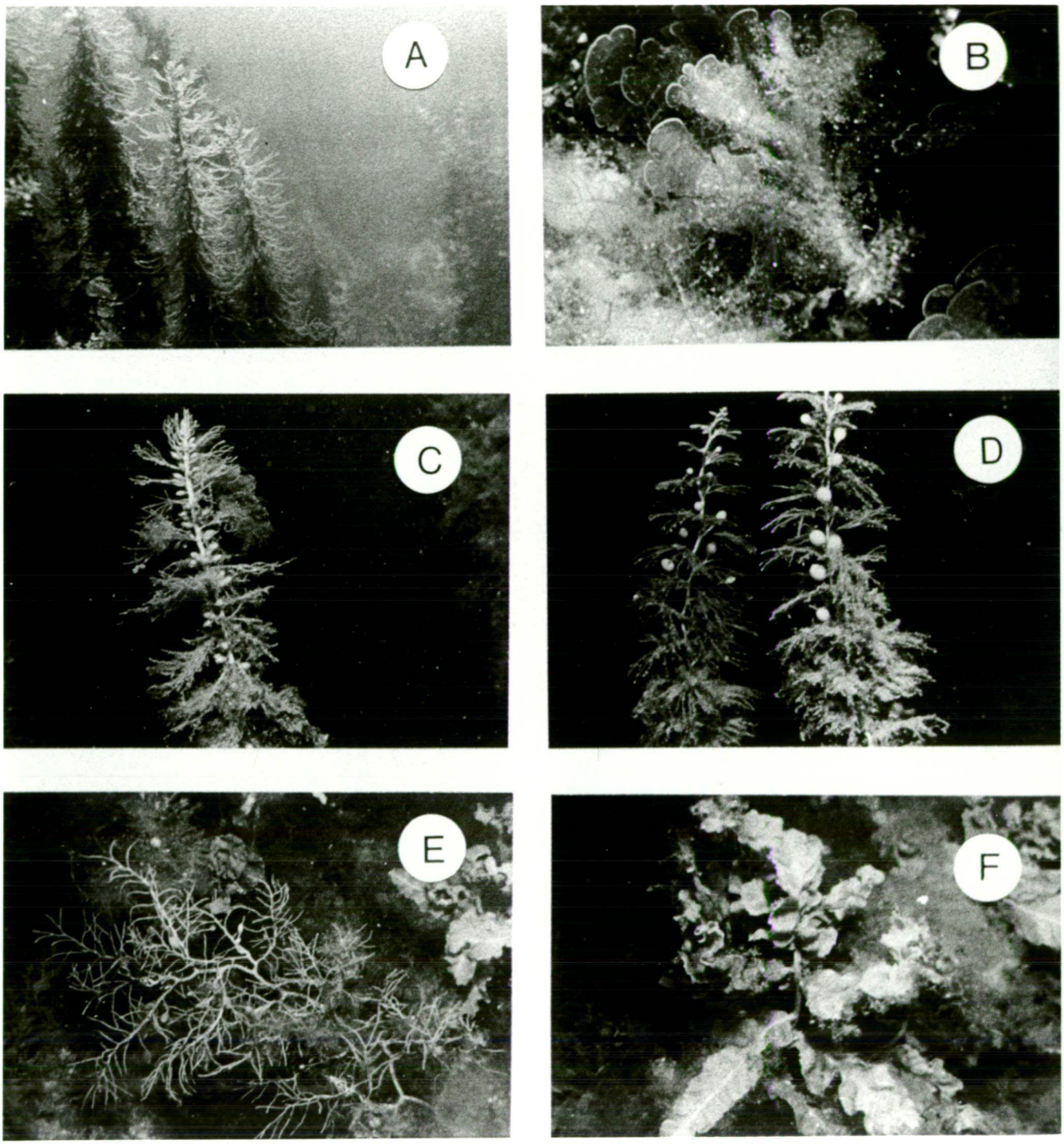
Although seagrass beds have been subject to intensive investigation for some time (e.g. from Petersen, 1918, to Phillips & McRoy, 1980), the importance of macro-algae as primary producers and as providers of structural complexity in the inshore environment has taken longer to be fully appreciated (Gore et al, 1981). Algal and seagrass ecosystems have many similarities and phytal animals frequently range between the two environments (Nagle, 1968), but they also differ in several respects. The abundances of animals in most seagrass habitats show relatively minor changes with season (Lappalainen et al, 1977; Rainer, 1981) but can vary greatly from year to year (Nelson, 1979b), while extreme changes in the abundances of animals associated with algae can occur predictably during the year (Mukai, 1971). Furthermore, the multispecific nature of many algal communities when coupled with variability in the phenologies of the dominant algae can result in a seasonally changing complex habitat which is unlike the more static seagrass systems.

In order to determine how the life-cycles of phytal animals correspond to changes in the plants within such a system, an investigation into seasonal change was carried out at Fancy Point. The site used was adjacent to the site discussed in the previous chapter but was more sheltered from wave action and had far fewer algal species. The five abundant species of macro-algae within this area, Sargassum bracteolosum, Sargassum verruculosum, Cystophora retroflexa, Caulocystis cephalornithos and Zonaria turneriana, are characteristic of sheltered, rocky reef environments in eastern Tasmania (Edgar, 1981).

3.2 STUDY SITE

The study was conducted on an evenly-sloping sandstone reef 100 metres east-south-east of the site discussed previously. The area sampled extended for a distance of 50 metres parallel to the shoreline and from the 2.5 to 4 metre depth contours below low water mark (a width of approximately 25 metres). The algal assemblage within the study area was reasonably homogeneous and extended from a depth of ≃1 metre to the edge of the sand at ≃5 metres. It was dominated by Sargassum bracteolosum, Sargassum verruculosum, Cystophora retroflexa, Caulocystis cephalornithos, with the less conspicuous Zonaria turneriana also being very abundant. The first four algal species can grow to lengths of over one metre, and, with the exception of S. bracteolosum and the very minor basal leaves of S. verruculosum, all have filament-like branches which are rounded in cross-section (Fig. 11). The basal leaves of S. bracteolosum are leaf-like (up to 3 cm wide) and the reproductive fronds are also flattened but much thinner. Cystophora has a semi-prostrate habit because the vesicles are insufficiently buoyant to lift the thallus into the water column in a way similar to S. verruculosum, Caulocystis and the reproductive fronds of S. bracteolosum. Zonaria is small in size with wide leaf-like fronds.

Fig. 11. Photographs taken on 4 Jan 1979 showing the habitat A, Zonaria turneriana (thallus length ≃9 cm) B, Caulocystis cephalornithos (thallus length ≃85 cm) C, Sargassum verruculosum (thallus length ≃80 cm) D, Cystophora retroflexa (thallus length ≃25cm) E, and Sargassum bracteolosum (thallus length ≃25 cm) F.


A
B
C
D
E
F

3.3 METHODS

3.3.1 Sampling Procedure

The densities of the five algal species were estimated on 3 June 1979 by counting the number of plants with holdfasts enclosed by a $0.25m^2$ quadrat dropped 25 times at random within the study area.

Seasonal changes in growth were assessed by tagging individual plants near their bases with aluminium tags and measuring the maximum length of labelled plants at intervals of from two to three months. Twelve replicate plants belonging to each species were initially tagged on 20 March 1980. Unfortunately, because of corrosion of the plastic-coated wire fasteners many of the metal tags had disappeared by 26 November 1980 and some of the plants could not be re-identified. The plants which remained tagged on $\leq$ 4 December 1980 were relabelled using plastic tags and fasteners, as were other plants to make a total of 10 replicates per species. The growth studies were concluded on 10 June 1982.

In the first week of each month from July 1978 to June 1979 five replicate samples of each of the five algal species were collected to determine the composition of the associated fauna. These plants were selected at random by throwing five marked weights within the study area, and, for each algal species, collecting the closest undisturbed plant to each marker. Each sample comprised an individual plant which was carefully enclosed underwater within a plastic bag and separated from the substratum at its base. Formalin ($\simeq$5%) was added to the contents of the bag within an hour of the plant's collection. The macrofauna retained by a 0.5mm sieve was separated from the plant in the laboratory using the procedures described earlier. The

filamentous epiphytes associated with each alga, such as Ceramium, Polysiphonia and Ectocarpus, were then removed by hand and the weights of the epiphytes and macrophyte itself were measured after pre-drying at 84°C for 48 hours.

Collections of the fish species commonly occurring within the study area were made during the sampling program using net, spear, fish trap and plastic bag. The diets of these fish were determined by identifying their gut contents; individual animals were counted and the percentage abundance of plants and colonial animals estimated.

3.3.2 Statistical Analysis

Canonical variate analysis (multiple discriminant analysis) was used to analyse differences in the faunal assemblages between the five algal species in the different months. The procedure is discussed by Seal (1964), and has been used in the marine context by Buzas (1967) and Shin (1982). It involves the construction of canonical variables to maximise the separation of pre-selected groupings of individuals. In this case the patterns of animal abundances of individual algae were grouped by algal species.

Preliminary univariate methods indicated that a logarithmic transformation was required to convert the abundances of the animal species to a scale on which the patterns of residuals followed a normal distribution. Thus, frequency counts were transformed by the natural logarithm + 1 before analysis, and then animal species were selected for inclusion in the CVA on the basis of their abundance, tests for skewness and kurtosis, and Bartlett's test (see Snedecor and Cochran, 1967, for discussion of normality tests).

The statistical significance of faunistic differences between algal species was tested by calculating the Mahalanobis Distance (D) between each of the five algal groupings (Rao, 1970). Two groups were regarded as different at the q% level of significance if their D value exceeded S, where

$$s^2 = (1/n_1 + 1/n_2)(d/(d+1-p))(p.F_{q,p,d+1-p})$$

and n_1 and n_2 are the number of replicates in each group (5 in this study),

p is the number of variables,

d is the number of degrees of freedom upon which the variance estimates were made,

$F_{q,p,d+1-p}$ is the tabulated F-value at q% level of significance for degrees of freedom p and d+1-p

3.4 HYDROLOGY

On each sampling date in 1978 and 1979 the temperature of the surface water was recorded, as were maximum and minimum bottom water temperatures for the past month which were read from a thermometer permanently attached to the rock substratum. Water temperature reached a peak of 21.2°C during February and was at its minimum of 7.5°C in July (Fig. 12).

Salinity information was collected at the same time as temperature data using either an Autolab Model 602 or a YSI Model 33 salinometer. The probe was lowered from a boat to approximately 1 metre above the reef surface. Salinities were reduced by heavy rainfall in August 1978, but did not fall lower than 31‰ on any sampling date (Fig. 12).

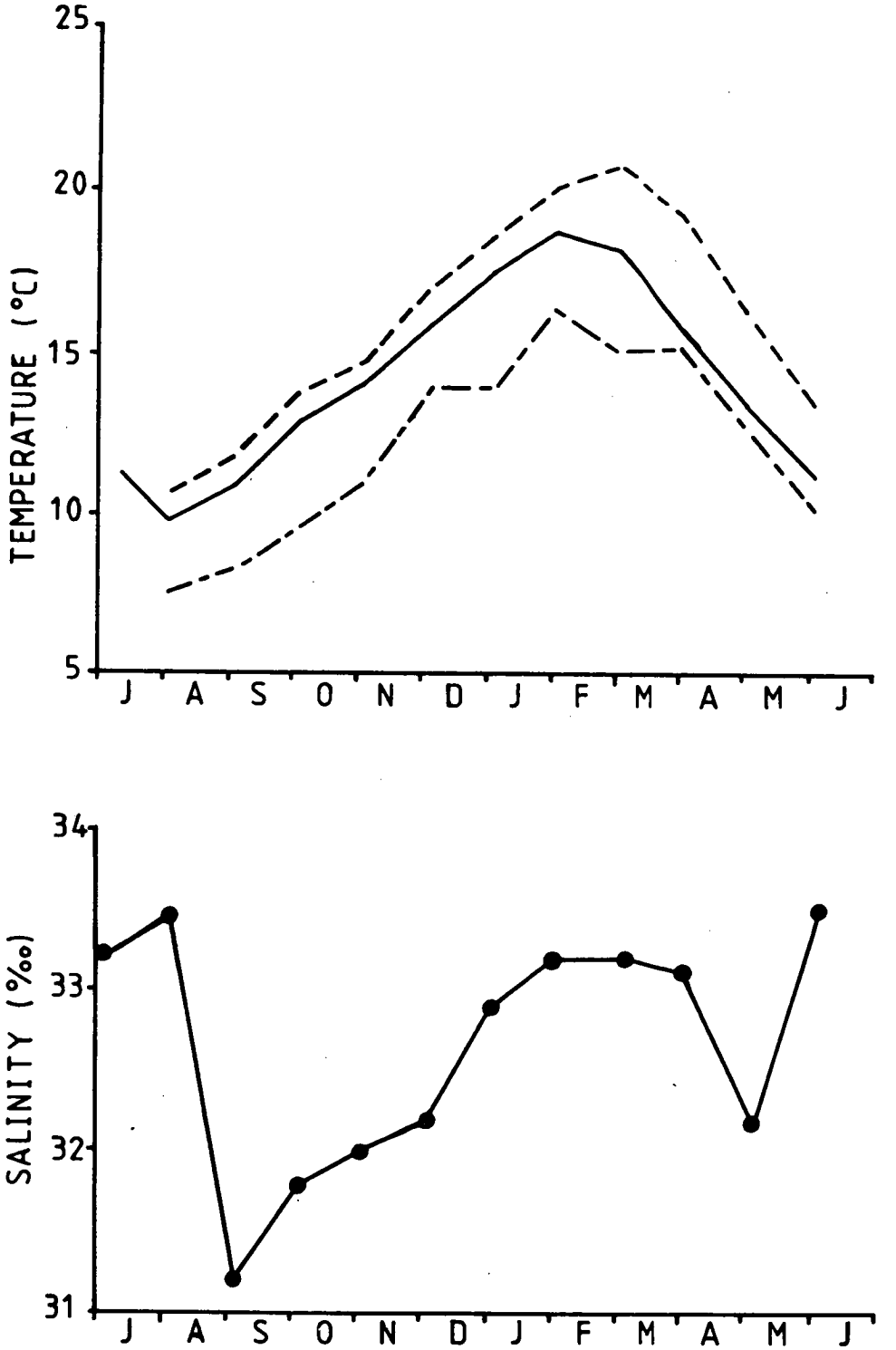


Fig. 12. Water temperatures and salinities recorded on sampling dates with maximum and minimum water temperatures for the preceding month.

3.5 RESULTS

3.5.1 Algal Abundance and Seasonality

Zonaria was the most abundant species in the study area, while S. bracteolosum and Caulocystis were dominant among the erect algae (Table XII).

Changes in the mean maximum lengths of the algal species during the 27 month study period are shown in Fig. 13. The lengths of the few tagged algae not sighted on a given sampling date, but found on the next occasion, were interpolated from length measurements on the preceding and following dates, and these estimated figures were used in the calculation of the mean maximum lengths.

Sargassum bracteolosum: Reproductive branches arose on S. bracteolosum in late October, and flourished during the summer period, but lost buoyancy in February and disappeared by mid-March. The maximum length declined steeply at this time (Fig. 13), but basal leaves then grew continuously until the next reproductive period. The species lost ≃25% of the tagged population per year.

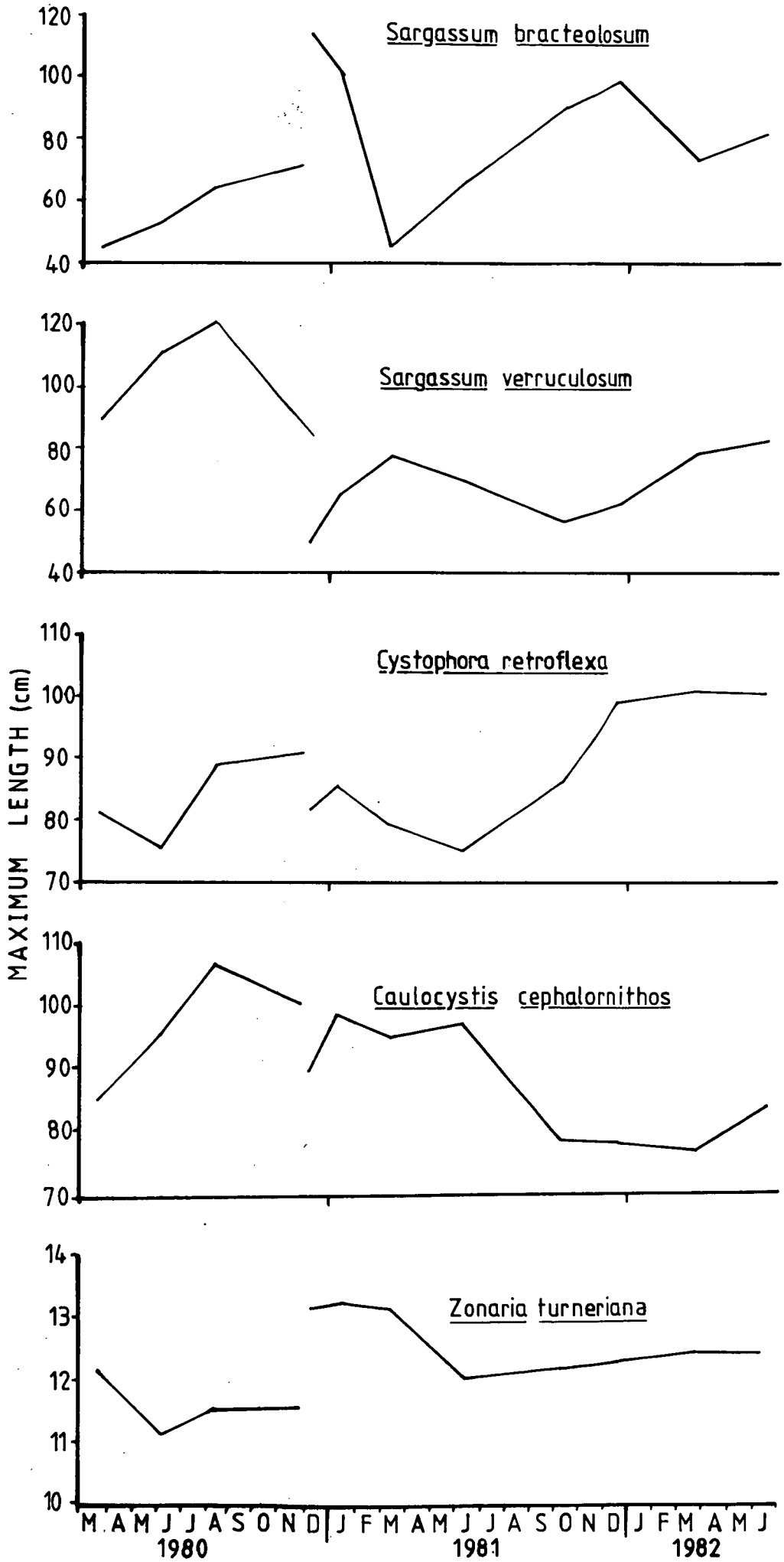
Sargassum verruculosum: Plants in the study area possessed several reproductive branches per holdfast throughout the year and contrasted greatly with shallower S. verruculosum (at ≃1.5m. depth) which lacked these structures from June until August.

S. verruculosum generally reached its maximum length in late autumn, and was the most obvious species at that time. It then declined during winter until new growth became evident in late spring. The plants survived for several years; tagged plants having ≃20% mortality per year.

TABLE XII. The mean densities of algal species within the study area on 3 June 1979.

Species	Mean Density (m^{-2})	Standard Deviation
Sargassum bracteolosum	5.44	4.74
Sargassum verruculosum	2.24	3.07
Cystophora retroflexa	2.08	3.08
Caulocystis cephalornithos	5.76	6.44
Zonaria turneriana	14.4	14.5

Fig. 13. Seasonal variation in the mean maximum lengths of tagged algae. A number of plants were added to the tagged population in December 1980 because of the loss of a large number of tags in the preceding months.


Sargassum bracteolosum
120
100
80
60
40
Sargassum verruculosum
120
100
80
60
40
MAXIMUM LENGTH (cm)
Cystophora retroflexa
110
100
90
80
70
Caulocystis cephalornithos
110
100
90
80
70
Zonaria turneriana
14
13
12
11
10
M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1980
1981
1982

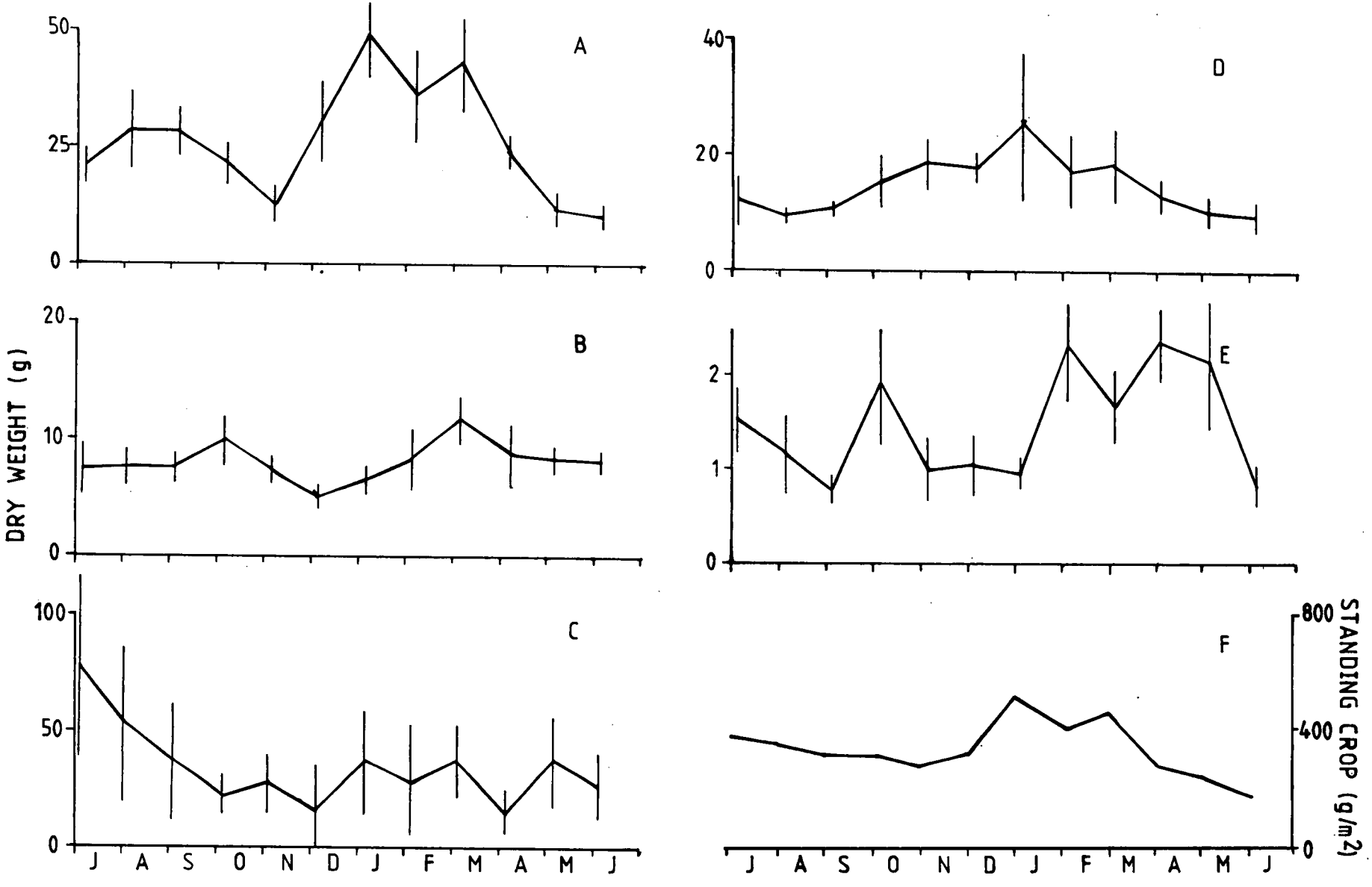
Cystophora retroflexa: Apart from a slight annual decrease in length in late autumn, this species grew continuously to a maximum length of ≃250cm. and an age estimated to be at least 6 years. The annual mortality rate of Cystophora was ≃50%, but a proportionately high number of small plants were lost.

Caulocystis cephalornithos: The phenology of this species varied between years and is difficult to interpret from maximum length information because several primary axes, each of varying lengths, were usually attached to a single holdfast. The primary axes generally reached maximum lengths in late autumn but they had lost buoyancy by this time and were denuded of all secondary axes other than those near the apices. Consequently, the biomass of Caulocystis was considerably greater over summer when many secondary axes were present than during the winter period (Fig. 14). Tagged plants were lost from the site at the rate of ≃25% per year.

Zonaria turneriana: The thalli of Zonaria were reduced in length in late autumn but increased slightly throughout the rest of the year. This small species suffered a very high annual mortality rate of ≃80% per year. This figure, however, may be influenced by the tagging process as labelled plants were handled regularly and the tags may have increased the water resistance of thalli in storms.

The estimated total standing crop of macrophytes and the mean weights of the algae sampled each month from July 1978 to June 1979 are shown in Fig. 14. Calculations of standing crop assume that the density of plants within the study area remained constant throughout the year. A slight violation of this assumption due (i) to the settlement of young plants, (ii) to the loss of algae by sampling (≃1.5% of the total population) and (iii) to natural

Fig. 14. Seasonal variation in mean dry weights of sampled Sargassum bracteolosum (A), Sargassum verruculosum (B), Cystophora retroflexa (C), Caulocystis cephalornithos (D), and Zonaria turneriana (E), and the estimated total standing crop (F). Standard error bars are indicated.


A
B
C
D
E
F
DRY WEIGHT (g)
STANDING CROP (g/m2)
50
25
0
20
10
0
100
50
0
40
20
0
2
1
0
800
400
0
J A S O N D J F M A M J

mortality, probably would not have affected results greatly because the larger species of algae were all found to survive for several years and no obvious changes in density occurred during the study period. While the abundances of smaller plants may have shown considerable seasonal variation, these algae did not contribute greatly to total macrophytic or epiphytic biomass.

The standing crop of macro-algae was greatest in summer due to the maximum biomass of Caulocystis and S. bracteolosum at this time (Fig. 14). Seasonal changes in the standing crop of the other three algal species could not be inferred from Fig. 14 because of the large variability in the weight of samples collected each month.

Seasonal changes in the biomass of epiphytes on all five algal species coincided and peaked in February and March (Fig. 15). The mean epiphytic weights then declined quickly and by May were reduced to low levels which were maintained until November.

3.5.2 Composition and Seasonality of the Faunal Assemblage

A total of over 175,000 animals belonging to 241 species were collected during the monthly sampling program. The fauna was dominated by amphipods but large numbers of polychaetes, molluscs, tanaids and isopods were also present. A list of the abundances of the phytal species in each month is given in Appendix 2.

Seasonal changes in animal density corresponded very closely with changes in epiphytic weight, with the maximum abundances of animals on all erect species of algae occurring in February and March (Fig. 16). The

Fig. 15. Seasonal variation in mean dry weights of filamentous epiphytes associated with sampled Sargassum bracteolosum (A), Sargassum verruculosum (B), Cystophora retroflexa (C), Caulocystis cephalornithos (D), and Zonaria turneriana (E), and the estimated standing crop of epiphytes (F). Standard error bars are indicated.

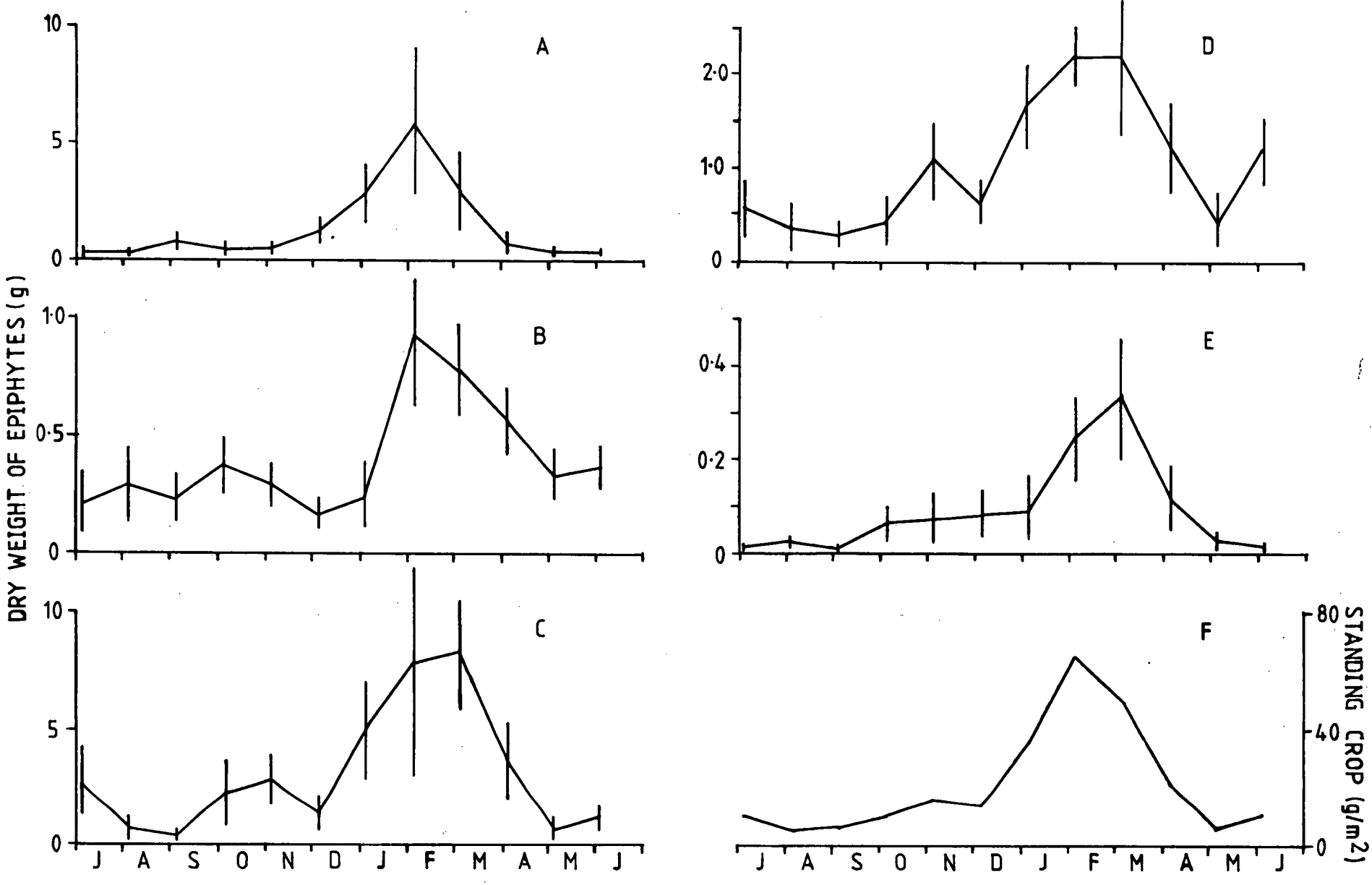
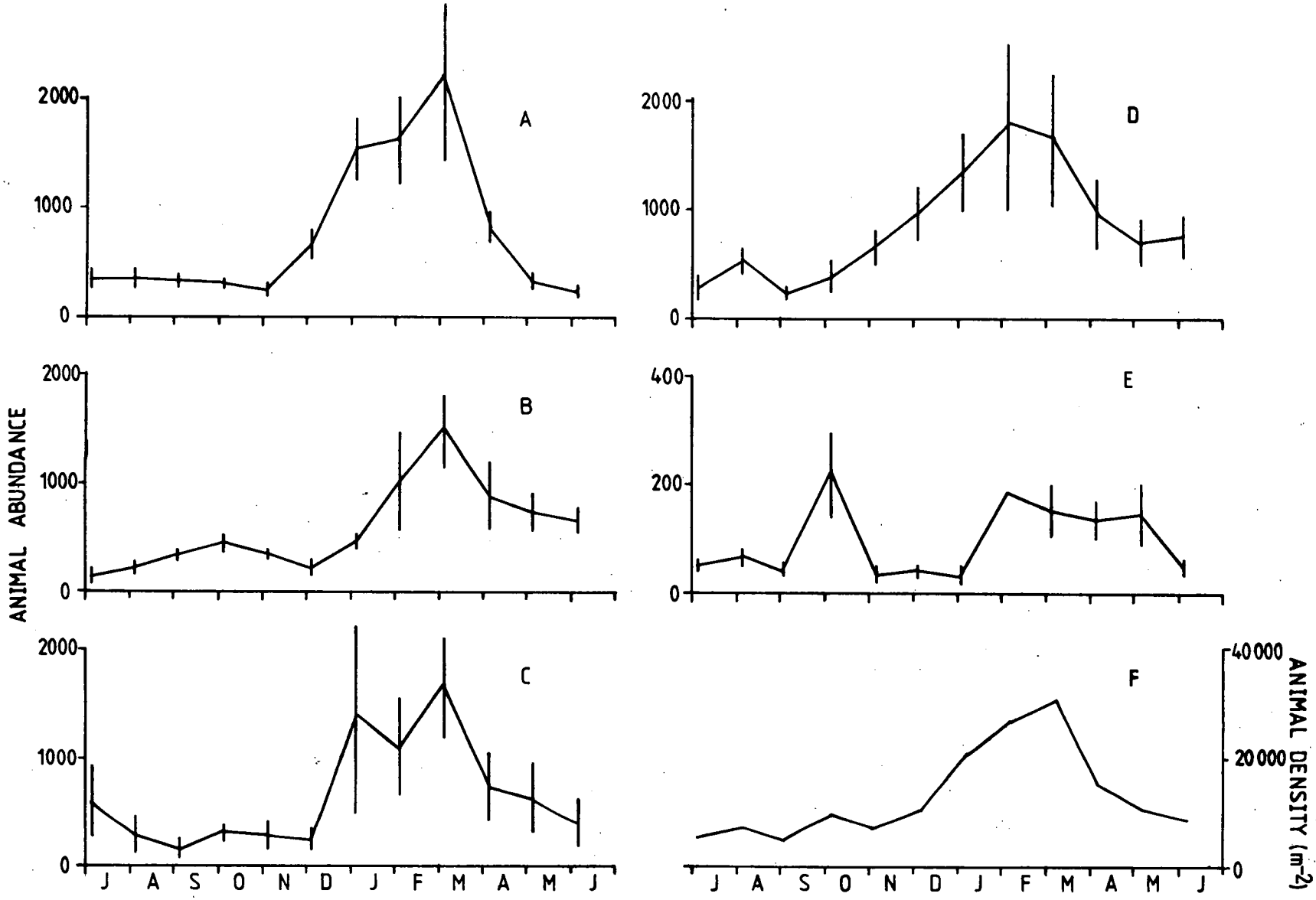

A
B
C
D
E
F
DRY WEIGHT OF EPIPHYTES (g)
STANDING CROP (g/m2)
10
5
0
1·0
0·5
2·0
0·4
0·2
80
40
J A S O N D J F M A M J

Fig. 16. Seasonal variation in the mean number of macrofaunal animals associated with sampled Sargassum bracteolosum (A), Sargassum verruculosum (B), Cystophora retroflexa (C), Caulocystis cephalornithos (D), and Zonaria turneriana (E), and the estimated density of phytal animals per square metre of reef substratum (F). Standard error bars are indicated.


A
B
C
D
E
F
2000
1000
0
400
200
40000
20000
ANIMAL ABUNDANCE
ANIMAL DENSITY (m-2)
J A S O N D J F M A M J

abundance of animals on Zonaria was also high in autumn, but a second peak occurred in October, and animal numbers showed a closer relationship to the weight of sampled plants than to the weight of epiphytes.

In order to determine whether the peak in animal abundance was caused by the extreme dominance of a few seasonally recurring species and whether animals showed differing preferences for algal species through the year, two-way analysis of variance was performed on the log (x+1) transformed abundances of each of the most common animal species.

Animal abundances differed significantly between the algal species (Table XIII), presumably largely because the mean weights of the five algae were vastly different. The gastropod Hydrococcus brazieri proved exceptional as it was associated with holdfasts, and numbers were relatively independent of plant size. A large number of phytal species showed changing relative patterns of abundance on the five algal substrata during the year, and these animals probably migrated between algal species.

The abundances of all 30 common animal species varied between months in a highly significant way. The majority of these species were most numerous between January and March. The pattern of late summer dominance is clearly seen in Fig. 17 where the number of species having unimodal seasonal abundance peaks in each month is shown. The abundances of very few animal species peaked in winter or spring.

With the exception of tanaids and polychaetes, the densities of all groups of animals were greatest between January and April (Table XIV). These groups included animal species at every secondary trophic level. The reason for the winter abundance peak in tanaids is unclear and awaits life history studies on this important but neglected group of animals. The apparently unseasonal peak in numbers of polychaetes in October was probably an artifact

TABLE XIII. Results of ANOVA comparing the log (X+1) transformed abundances of the common animal species in different months on different algal species.
*, 0.05>p>0.01; **, 0.01>p>0.001;***, p<0.001.

Animal Species	Months	Species	Interaction	Total Abundance
Munna sp.	9.78***	15.67***	1.54*	1459
Paratanais sp.	14.36***	39.30***	2.01***	6936
Paradexamine churinga	66.11***	91.92***	1.81**	57188
Tethygeneia sp.1	15.09***	47.63***	1.57*	4696
Aora hircosa	11.43***	39.73***	1.63*	6276
Lembos sp.1	11.79***	4.41**	0.94	1981
Ampithoe sp.1	6.03***	102.2***	1.42	6503
Cymadusa sp.1	20.07***	60.90***	2.88***	13782
Haplocheira barbimana	2.14*	18.41***	1.12	1105
Corophium sp.	23.96***	6.38***	1.58*	936
Ampithoe sp.2	3.40***	26.59***	3.57***	806
Ampithoe sp.3	3.31***	143.7***	3.07***	954
Caprella aequilibra	42.10***	23.59***	3.84***	1170
Nannastacus inflatus	5.03***	25.04***	1.17	1094
Siriella sp.	42.59***	20.18***	3.04***	1566
Pontomyia sp.	27.05***	4.27**	1.39	5854
Diala lauta	9.43***	31.77***	1.40	9420
Diala monile	23.11***	64.35***	1.89**	5092
Phasianotrochus eximinius	9.53***	44.85***	1.81**	1242
Macrozafra atkinsoni	6.77***	58.28***	2.30***	2619
Hydrococcus brazieri	16.16***	1.96	1.52*	4255
Diala translucida Hedley	34.12***	110.3***	3.45***	4835
Platynereis dumerilii	21.25***	36.46***	1.39	5804
Syllides longocirrata	8.98***	45.04***	1.73**	4572
Pionosyllis sp.	33.31***	20.05***	2.28***	1058
Polynoidae A	24.36***	4.97***	0.86	1391
Exogone gemmifera	4.01***	37.40***	1.67**	8907
Exogone verugera	5.02***	11.17***	0.89	2098
Brania rhopalophora	15.05***	15.86***	1.53*	2499
Harmothoe sp.	48.15***	4.54**	1.48*	978

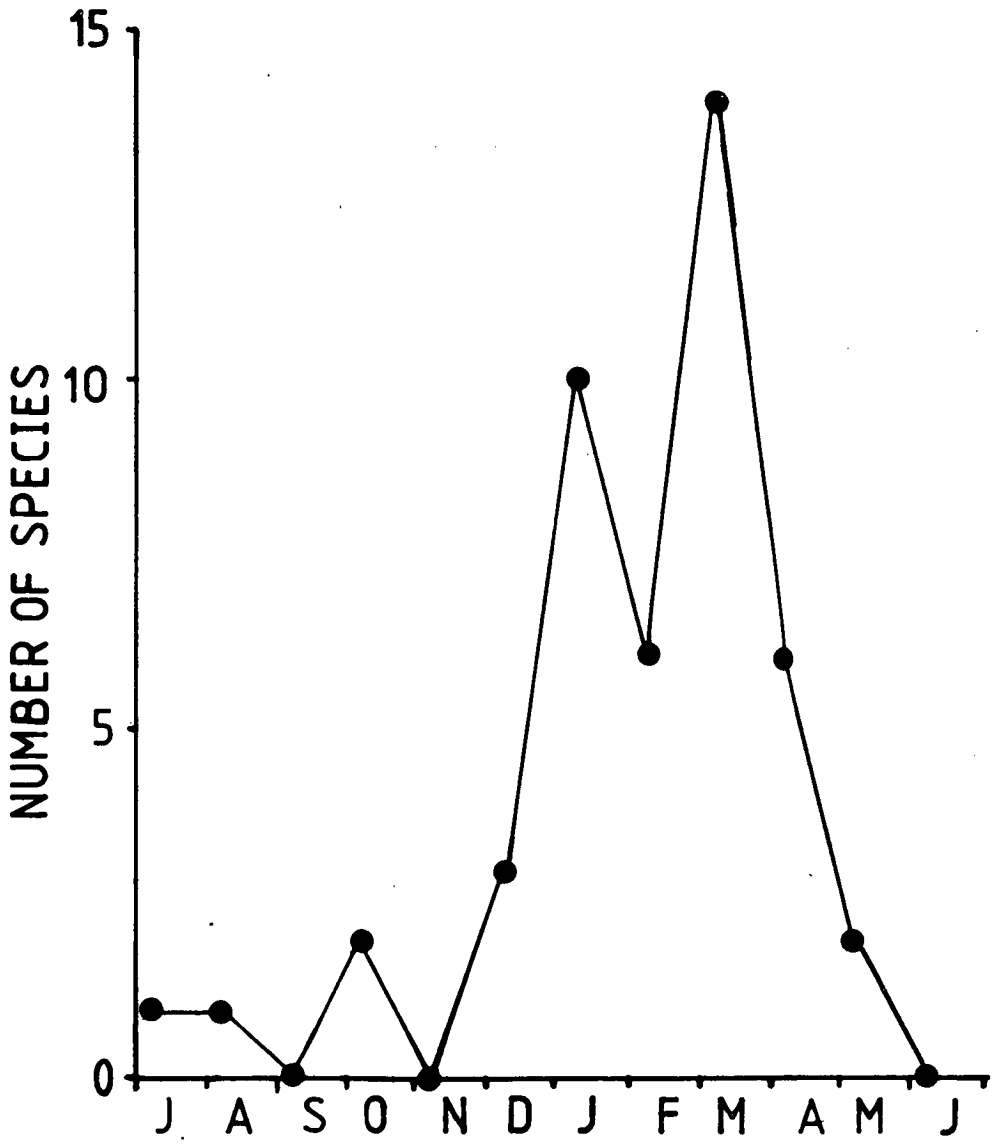


Fig. 17. The number of animal species showing distinct unimodal peaks of abundance in each month.

TABLE XIV. Estimated densities of major animal groups per square metre of reef substratum.

Animal Group	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Gammaridean Amphipoda	1695	1193	1080	1733	2658	6189	12821	16972	18914	8532	5639	4429
Caprellid Amphipoda	51	16	4	32	13	108	388	285	123	36	38	36
Isopoda	101	84	97	188	127	330	586	334	342	147	148	175
Tanaidacea	1026	974	580	920	715	804	411	95	127	141	284	336
Mysidacea	35	25	1	9	5	105	203	400	494	100	35	4
Cumacea	52	113	37	35	52	42	124	116	160	154	63	59
Decapoda	40	125	49	29	23	27	23	212	300	107	67	23
Brachyura	6	10	8	2	7	7	10	16	15	39	16	13
Anomura	44	18	16	21	10	11	43	25	47	34	21	15
Insecta	155	195	232	219	5	320	118	1674	1592	352	715	342
Gastropoda	1800	2149	1420	1234	1191	722	1376	3187	5883	2870	1350	1241
Chaetognatha	3	0	0	4	2	15	8	23	38	44	4	0
Echinodermata	23	20	18	11	11	18	46	21	66	40	28	21
Polychaeta	746	1866	1342	4165	1880	1912	4004	2918	2412	2756	2340	2250
Oligochaeta	8	2	7	6	49	5	201	13	27	70	50	47
Nemertea	3	0	2	6	5	4	8	0	6	22	12	13
Others	6	17	4	2	5	16	11	7	18	43	18	5

produced by the collection in that month of unusually large Zonaria which were dominated by Exogone gemmifera. The number of polychaetes was consistently high in summer and autumn. Nevertheless, the stability of polychaete numbers throughout the year was exceptional and contrasted greatly with the rapid changes in population levels of other animal groups. As a result polychaetes comprised 48% of the total abundance of animals in October but only 8% in March. Amphipods showed very rapid population increases during summer and comprised 62% of all animals in March, but then declined more quickly than the other major groups to represent 22% of total numbers in September. The abundances of molluscs and isopods changed less rapidly but five-fold differences in numbers between early autumn and winter were still evident.

3.5.3 Comparison of Faunas on Differing Algal Species

Preliminary analyses indicated that the log transformed frequencies of only 13 of the 30 abundant animal species given in Table XIII followed a normal distribution. The frequencies of these 13 species, which are listed in Table XVI and comprised 69% of the total animal numbers, were employed as variables in the canonical variate analysis.

The Mahalanobis Distances between algal species in each of the 12 months are given in Table XV. The faunal assemblage associated with Zonaria was substantially different from the assemblages present on the other four algal species. No other consistent differences were evident between algal species either throughout the year or for a period of successive months.

TABLE XV. Mahalanobis Distances between each pair of algal species in each month calculated using the log(x+1) transformed abundances of 13 animal species (S-Sargassum bracteolosum, V-Sargassum verruculosum, R-Cystophora retroflexa, C-Caulocystis cephalornithos, Z-Zonaria turneriana).

*, 0.05>p>0.01; **, 0.01>p>0.001.

Month	Z-S	Z-V	Z-R	Z-C	S-V	S-R	S-C	V-R	V-C	R-C
J	7.8*	7.0*	7.9*	7.8*	6.9*	3.6	6.1	5.3	2.2	4.6
A	7.6*	4.8	4.3	6.8*	7.1*	5.8	6.4	3.9	3.2	4.4
S	7.2*	6.9*	3.4	8.6**	6.1	8.2*	8.2*	7.4*	3.7	9.5**
O	5.5	8.7**	4.6	5.7	5.8	4.3	3.1	5.5	4.7	3.7
N	6.9*	7.2*	8.5**	9.9**	5.8	3.7	6.4	4.9	4.8	5.5
D	5.6	4.4	5.4	8.3*	4.8	5.7	5.3	4.0	6.7	9.6**
J	9.8**	8.9**	8.4*	8.9**	5.6	7.2*	2.8	5.4	4.8	5.5
F	5.1	5.9	3.8	4.7	4.7	3.4	4.2	4.5	5.5	2.9
M	10.4**	8.2*	9.5**	7.4*	4.2	3.5	4.9	3.8	2.7	4.4
A	8.9**	7.1*	6.6*	6.3	5.6	5.2	4.8	4.4	3.3	3.6
M	5.3	6.2	4.2	5.6	4.7	4.3	5.1	3.9	3.7	3.8
J	6.0	7.5*	5.1	7.6*	6.6*	3.1	6.7*	5.3	3.6	5.3

Because the number of variables (13) was large relative to the number of plants sampled in each month (25), it was considered that the power of the paired comparison test may have been low and further differences between faunal assemblages existed than indicated by Table XV. This was tested by reducing the number of variables included in the analysis.

Five variables (the log transformed abundances of Pontomyia sp., Paradexamine churinga, Tethygeneia sp.1, Aora hircosa and Nannastacus inflatus) were selected as being most important in the comparison of algal species after reference to the weightings of the variables in the transformation to canonical variate means (Table XVI). The abundances of these species represented 43% of total numbers.

As expected, the reduced number of variables resulted in many more significant differences between the faunal assemblages of the algal species becoming evident (Table XVII). The fauna of Zonaria was again clearly different to that of the other species. Phytal animals did not appear to distinguish between Caulocysis and S. verruculosum in any month of the year even though the phenologies of these species were markedly different. The most interesting finding of this analysis was that only two minor significant differences existed between the wide-bladed S. bracteolosum and the three thin-branched erect algae between February and May, whereas during the other months of the year significant faunal differences were usually evident. This cannot be attributed to phenological changes in S. bracteolosum as reproductive branches were only present from October to March. Phytal animals may not be able to distinguish between algal species in autumn because the heavy growth of epiphytes masks the physical structure of the algae at this time.

TABLE XVI. Weightings of the variables in the transformation to canonical variate means.

Canonical Variate 1

Animal Species	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Pomtomyia sp.	0.5	-2.8	-1.0	0.3	1.3	-1.3	-1.8	0.3	-1.2	-1.0	0.5	0.4
Paradexamine churinga	1.2	0.0	0.2	1.3	-1.9	2.2	-3.8	0.1	-1.3	4.0	-2.4	1.7
Tethygeneia sp.1	-1.4	0.1	-1.4	-1.4	-0.2	-4.4	1.5	-2.6	-0.1	-3.5	0.9	0.2
Aora hircosa	-0.5	1.1	-2.4	0.2	2.7	1.5	0.1	-0.7	-0.9	-0.3	2.0	-1.2
Lembos sp.1	-0.3	-1.2	0.0	1.5	-1.0	-0.2	0.8	-1.3	-0.6	2.2	0.0	-0.1
Cymadusa sp.1	-1.3	-0.1	-0.6	-1.1	-1.2	1.2	0.3	0.5	-0.7	-0.4	-0.2	1.2
Munna sp.	0.9	-1.2	0.4	0.3	-0.7	-0.9	-1.3	0.6	0.2	0.0	-1.6	-1.6
Paratanais ignotus	1.7	0.3	2.1	-1.0	-1.0	-1.9	-0.1	-0.1	0.4	0.5	-0.5	0.5
Nannastacus inflatus	-0.5	0.0	-0.6	-0.4	0.5	0.2	2.6	2.2	1.5	-0.7	-0.4	1.3
Diala lauta	0.8	0.0	2.1	-0.5	-0.6	-0.3	-0.9	-2.2	2.1	-0.4	1.2	-0.2
Hydrococcus brazieri	0.1	2.7	2.2	0.8	0.7	0.7	1.6	1.7	-0.4	-0.4	-0.7	0.2
Platynereis dumerillii	-0.5	1.9	-3.7	-0.6	-0.3	0.2	0.8	2.4	-1.5	2.1	-0.8	-1.0
Exogone verugera	0.3	-0.6	-0.5	1.3	1.5	1.3	0.1	0.7	0.7	-0.2	0.2	0.1

Canonical Variate 2

	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Pontomyia sp.	0.2	-0.5	0.0	0.0	0.0	0.7	-0.5	-0.7	-0.5	-0.2	1.4	-1.4
Paradexamine churinga	-1.9	1.4	0.4	0.9	0.4	-1.7	2.3	-0.3	0.1	1.4	0.5	1.1
Tethygeneia sp.1	0.0	-0.1	1.7	-0.4	2.1	0.8	-0.3	-0.7	-0.5	-2.7	1.5	0.0
Aora hircosa	1.7	-1.3	1.5	-1.6	-1.4	0.0	-0.7	-1.0	0.2	1.0	-1.3	-0.2
Lembos sp.1	-0.3	0.3	-0.7	-0.6	1.9	0.3	-0.1	0.8	-0.1	2.3	0.9	-0.4
Cymadusa sp.1	-0.4	-0.7	-1.8	0.8	-0.7	-0.2	-0.1	-0.9	0.3	-0.8	-1.6	-2.4
Munna sp.	-0.5	0.1	0.1	0.4	0.9	0.8	-1.0	0.3	1.0	1.5	0.0	3.8
Paratanais ignotus	-0.6	1.4	1.4	-0.5	-0.3	0.0	-1.1	0.3	-0.4	0.5	-0.1	0.0
Nannastacus inflatus	0.6	0.4	-2.0	-0.3	2.2	0.6	1.3	-0.4	-1.2	-1.6	0.2	0.9
Diala lauta	1.4	-0.4	1.5	-0.6	-0.4	-0.2	-1.1	-0.1	-0.1	0.2	-1.6	0.0
Hydrococcus brazieri	-0.8	-0.5	0.1	0.5	0.3	0.1	0.6	1.0	0.4	-0.5	0.1	-0.1
Platynereis dumerillii	-0.2	-0.6	-2.3	0.1	-0.9	-0.6	-0.4	0.8	0.5	0.4	1.8	0.0
Exogone verugera	1.4	0.6	-0.6	0.2	-0.8	-0.1	0.7	1.3	-0.7	-0.8	-1.3	-0.1

TABLE XVII. Mahalanobis Distances between each pair of algal species in each month calculated using the log(x+1) transformed abundances of 5 animal species (S-Sargassum bracteolosum, V-Sargassum verruculosum, R-Cystophora retroflexa, C-Caulocystis cephalornithos, Z-Zonaria turneriana).

*, 0.05>p>0.01; **, 0.01>p>0.001;***, p<0.001.

Month	Z-S	Z-V	Z-R	Z-C	S-V	S-R	S-C	V-R	V-C	R-C
J	3.2*	3.6**	3.8**	3.7**	4.0**	1.7	3.5**	3.2*	0.7	2.8*
A	2.6	2.6	2.3	3.6**	3.4**	2.7*	4.2**	2.4	2.0	2.4
S	4.8***	4.0**	1.6	3.2*	2.8*	5.6***	2.7*	4.2**	1.4	3.7**
O	2.0	3.3*	2.3	2.3	4.2**	3.2*	2.6	2.6	2.5	1.3
N	4.1**	3.8**	4.5***	5.5***	3.2*	1.8	4.5***	2.9*	2.3	3.6**
D	4.0**	3.1*	3.1*	5.1***	2.0	1.7	2.9*	1.6	2.5	3.6**
J	5.9***	5.5***	6.7***	6.0***	2.7*	2.3	1.9	2.0	1.7	2.1
F	2.3	3.0*	2.4	2.3	2.0	1.5	1.5	0.9	1.9	1.6
M	5.8***	4.8***	6.1***	4.5***	2.0	2.7	2.8*	2.8*	1.0	3.0*
A	4.5***	4.7***	4.6***	4.8***	2.7	2.9*	2.2	2.0	1.4	3.0*
M	1.9	3.4**	2.3	3.1*	2.7	2.0	2.5	1.5	0.9	1.1
J	3.3*	5.8***	3.9**	6.8***	3.2*	1.7	4.1**	2.5	1.3	3.2*

3.5.4 Diet of Fish

Table XVIII presents the results of the gut contents analysis for 14 species of fish collected within the study area. Only one fish species, Acanthaluteres spilomelanurus (Quoy & Gaimard), had a large proportion of plant material within its diet. Other species can be divided into those primarily feeding on the phytal macrofauna discussed in this study (Nesogobius pulchellus Castelnau, Neoodax balteatus Cuvier & Valenciennes and Cristiceps australis Cuvier & Valenciennes), those primarily feeding on meiofauna (Trachinops caudimaculatus McCoy, Leptonotus semistriatus Kaup, Stigmatopora argus (Richardson) and Hippocampus breviceps Peters), those primarily feeding on benthic macrofauna (Vincentia lemprieri Johnston, Heteroclinus heptaeolus (Ogilby), Heteroclinus perspicillatus (Cuvier & Valenciennes), Gymnapistes marmoratus (Cuvier & Valenciennes) and Scorpaena ergastulorum Richardson) and an undescribed species of Nesogobius which fed on infaunal amphipods. Nesogobius pulchellus, Neoodax balteatus and Acanthaluteres spilomelanurus were all extremely abundant within the study area.

3.6 DISCUSSION

3.6.1 Seasonality of plants

Tropical and temperate marine plants are generally considered to show opposing phenologies (Conover, 1964). The standing crops of temperate species are greatest in summer while those of tropical species reach maxima during periods of low water temperatures (De Wreede, 1976). The phenologies of the algae investigated in this study agree with the suggestion of Conover (1958)

Table XVIII. Mean abundances of prey taxa within the guts of fish collected in the study area. Abbreviations of fish species are as follows: T.c. Trachinops caudimaculatus, V.l. Vincentia lemprieri, N.p. Nesogobius pulchellus, L.s. Leptonotus semistriatus, S.a. Stigmatopora argus, N.b. Neoodax balteatus, H.h. Heteroclinus heptaeolus, H.p. Heteroclinus perspicillatus, H.a. Hippocampus breviceps, A.s. Acanthaluteres spilomelanurus, C.a. Cristiceps australis, S.e. Scorpaena ergastulorum, G.m. Gymnapistes marmoratus, N.sp. Nesogobius sp.

	Fish Species													
	T.c.	V.l.	N.p.	L.s.	S.a.	N.b.	H.h.	H.p.	H.a.	A.s.	C.a.	S.e.	G.m.	N.sp.
Number of sampled fish	2	1	9	5	4	9	2	4	3	27	6	1	2	1
Prey Taxon														
Tethygeneia sp. 2									0.7					
Aora hircosa									0.3					
Ampithoe sp.1							1			0.1				
Cymadusa sp.1			0.3			0.5	0.5			0.2				
Paradexamine churinga			0.2	0.8					1	0.4	0.3			
Amphilochidae										0.1				
Phoxocephalidae			0.5							0.1				3
Haustoridae														6
Unidentified Amphipoda	0.5		0.6			1.2					0.3			
Caprella sp.									0.3					
Paratanais sp.	0.5									0.2	0.3			
Paratanais ignotus			0.1							0.6				
Leptochelia sp.			0.4							0.2				
Siriella sp.					0.3					0.2				
Nannastacus inflatus			0.1											
Munna sp.				0.4										
Unidentified Isopoda										0.2				
Harpacticoid Copepoda	21		1.5	17	19	1.4			70	0.8				
Calanoid Copepoda				1.0	0.8				0.7					
Ostracoda			0.1						0.3	0.1				
Lysiosquilla sp.		1												
Alpheus sp.			0.1											

Table XVIII (Cont.).

Prey Taxon	Fish Species												
	T.c.	V.l.	N.p.	L.s.	S.a.	N.b.	H.h.	H.p.	H.a.	A.s.	C.a.	S.e.	G.m.	N.sp.
Pontophilus sp.													0.5	
Jasus novaehollandiae			0.1											
Palaemon serenus													0.5	
Macrobrachium intermedium						0.1		0.5						
Chlorotocella leptorhynchus								0.3			0.3	1		
Unidentified Brachyura							1.5			0.1				
Unidentified Crustacea						0.3							2.5	
Pontomyia sp.			0.9							1.1	0.2			
Unidentified Insecta										0.1				
Pycnogonida										0.1				
Cephalopoda												1		
Hydrococcus brazieri						0.1				0.1				
Diala lauta						1.3	0.5							
Diala monile						0.4								
Unidentified Gastropoda										0.1				
Pelecypoda						0.4				0.2				
Foraminifera						0.1								
Platynereis dumerillii										0.1				
Exogone gemmifera										0.1				
Bhawania sp.										0.1				
Unidentified Polychaeta										0.1	0.2			
Oligochaeta										0.1				
Bryozoa										1.7%				
Chlorophyta										26%				
Rhodophyta										16%				
Phaeophyta										23%				
Unidentifiable material					25%	30%				22%			2.5%	

that two major algal growth pulses are observed in temperate waters; one in spring-summer and one in winter-spring. Sargassum bracteolosum, Cystophora retroflexa, Caulocystis cephalornithos and Zonaria turneriana have maximum growth rates in winter-spring while Sargassum verruculosum grows most rapidly over summer.

Tropical 'winter' and temperate 'summer' species have been found to occur in geographically adjacent populations in subtropical Florida (Prince & O'Neal, 1979; Prince, 1980). It seems that 'winter' plants also occur in the more temperate waters of Japan because the growth rates of Sargassum serratifolium, as reported by Mukai (1971), are maximal in autumn and the standing crop is greatest in winter and spring. Since Mukai also investigated seasonal change in the faunal assemblage associated with this species, his results provide an interesting contrast to the findings discussed later in this study on monthly changes in the faunas of 'summer' Sargassum species.

The phenologies of epiphytic algae have been poorly investigated in the past. It is likely that epiphytes generally respond to the same environmental conditions as macro-algae and consequently have similar phenologies (see Conover, 1964). Sargassum muticum was found to be heavily colonised by epiphytes in the British Isles shortly after the onset of fertility in summer (Jephson & Gray, 1977). The biomass of epiphytes, including the epiphytic fauna, was greatly reduced in winter because the reproductive fronds of Sargassum senesced and were lost at this time, carrying the epiphytes with them. In the present study the standing crop of filamentous algae showed a pronounced peak in late summer and then quickly declined. This occurred on all algae including those which maintained permanent axes. Brauner (1975) and Penhale (1977) found that epiphytic algae associated with seagrasses also declined in autumn and reached minimum biomass levels in winter.

It is notable that Mukai (1971) did not discuss the role of epiphytes within his study area. This may have been due to the presence of insignificant numbers of epiphytes during winter at the time when macrophytes reached their greatest size, and the lack of substrata in summer when filamentous algae would be expected to bloom.

3.6.2 Composition of the Faunal Assemblage

Due to the presence of a fine layer of silt on the algae collected in this investigation, detritivorous animals (notably molluscs, oligochaetes and chironomids) were found to have greater relative abundances than in the previous study. Nevertheless, the faunal assemblage reported here is very similar to that occurring among the same algae in depths greater than 2.3 metres at the former, more exposed study site.

Nagle (1968) applied Thorson's (1957) concept of parallel benthic assemblages to the algal environment and found that the dominant phytal animals reported from throughout the world fell into several well-defined groups. The results of this Tasmanian study confirm his findings as almost all the abundant taxa belong to groups of animals considered to be typical of phytal habitats.

3.6.3 Seasonality of Phytal Animals

Considering the divergent responses shown by different animal groups to different shaped algae and depths, the similarity in the seasonal density fluctuations of these groups is remarkable. A seasonal factor was obviously exerting a very strong influence on the phytal community. Pronounced seasonal

peaks in the abundance of phytal animals have been reported previously by Hagerman (1966) and Mukai (1971); and Heck & Orth (1980) found that similar phenomena could also occur in temperate seagrass habitats.

Several recent investigations in subtropical seagrass habitats, lacking regular monthly faunal changes, have shown that animal densities respond closely to the biomasses of seagrasses and drift algae, and these physical variables have been equated with structural complexity (Stoner, 1980; Gore et al, 1981). The reduced foraging efficiency of predators within densely vegetated areas compared to more open areas is thought to allow large populations of macro-invertebrates to exist (Stoner, 1979; Heck & Orth, 1980; Stoner, 1982).

At Fancy Point, the almost identical patterns of monthly variation in epiphytic weight and animal abundance suggests that these two variables are directly related. A response of phytal animals to filamentous, rather than benthic algae, during the period of maximum epiphytic biomass would also account for faunal differences between erect algae becoming obscured at that time. Furthermore, close relationships between epiphytic algae and animal abundances have been found previously by Wieser (1959), Hagerman (1966) and Nagle (1968), while Jansson (1974) showed that fluctuations in the density of macrofauna corresponded directly with changes in the standing crop of filamentous Cladophora and Ceramium. Studies in moderately exposed areas, which presumably have little epiphytic growth, indicate that seasonal changes in animal abundance are relatively slight and may vary among sympatric algal species (Hicks, 1977; Moore, 1977). The surprising lack of correlation between animal abundance and epiphytic weight which was found in the spatial study was almost certainly due to the very low dry weights of the epiphytes which were present. Assuming that animals find a refuge from predators amongst densely-

tufted filamentous algae, epiphytic levels along the more exposed shore of Fancy Point may well have been below a threshhold level required for changes in predation pressure to occur. Nelson (1979a) and Heck and Thoman (1981) found that the predation-habitat complexity relationship is probably a step function with constant predation levels occurring below a critical plant standing crop.

As well as being comparatively inaccessible to external predators, phytal grazers and detritivores living amongst dense growths of filamentous algae would also benefit from the considerable abundance of food resources, while suspension feeders would be expected to be seasonally disadvantaged. This latter aspect could not be assessed as negligible numbers of suspension feeding animals were collected during every month of the algal sampling program. Almost all of the abundant species of amphipods, molluscs, isopods and polychaetes would have included epiphytic material in their diets (Hagerman, 1966; Jansson, 1967; Fauchald & Jumars, 1979). The large numbers of these animals in summer and autumn would also have contributed to the maximum abundances of small phytal predators such as decapods, crabs and nemerteans which occurred at the same time.

In this seasonal study, as in the previous spatial study, animal species were wide-ranging among algal species but differences could be detected in the relative abundances of these animals on dissimilar plants. Therefore, populations of phytal animals in areas with a mosaic of macrophyte species are not likely to be greatly affected by the concurrent increase and decrease in the mean sizes of algae if total standing crop remains constant, particularly since animals move amongst plants (see Chapter 4). However, even though the standing crop remained relatively constant at Fancy Point, changes in total biomass of macro-algae may be as important as changes in epiphytic abundance.

Mukai (1971) found that the smaller, truly phytal species of animals associated with winter growing Sargassum had peaks of abundance in winter while the populations of the larger species (echinoderms, actinians, mysids and decapods) were not synchronized with the standing crop and were greatest in summer.

Consequently, in Tasmania it is unlikely that the life-cycles of the large, comparatively long-lived species were adapted to coincide with seasonal fluctuations in epiphytic biomass. The increase in numbers of these animals in summer is probably due to co-incidental annual recruitment and the migration of individuals from the nearby, more exposed area lacking the epiphyte cover.

On the other hand, it appears that most of the smaller phytal species, particularly those without pelagic larval stages, are highly opportunistic and can quickly take advantage of available resources at any time of the year. Hicks (1979) argued strongly that phytal harpacticoid copepods are adapted to maximise reproductive effort in times of abundant food resources. Among his findings he noted that Thalestris longimana invaded the filamentous alga Ceramium rubrum when the ephemeral plant was present (from late spring to autumn) and became reproductively active only at that time.

The rates of increase of the different animal groups during periods of optimal food supply varied considerably, but many groups showed monthly doubling of population sizes in late spring and early summer. The decrease in animal numbers in autumn was equally rapid, indicating that recruitment was low but mortality was very high at this time of year. As it was unlikely either that mass emigration of animals occurred, because of limited algal growth in adjacent habitats, or that the fauna was reduced by extreme physical factors, predators must have been responsible for this decline in population levels. The gut contents of two carnivorous (Neoodax balteatus and Nesogobius

pulchellus) and one omnivorous (Acanthaluteres spilomelanurus) fish contained many of the phytal species discussed in this study, and these predators were extremely abundant within the study area. Predation pressure exerted by these resident fish is probably relatively high throughout the year, but is maximal in autumn due to the increased metabolic rates of animals at higher water temperatures, considerable prey densities, and declining structural complexity of filamentous algae. Moreover, small phytal predators such as shrimps and crabs were also very abundant at this time. Recruitment of phytal animals probably would be concurrently low because competition among the many animals for declining levels of epiphytes would be expected to result in a lowered calorific intake which is channelled toward growth rather than reproduction. Overgrazing at this time may be the reason for the decrease in maximum lengths of Zonaria and Cystophora plants which was shown by the tagging program. Direct physical aggression between animals, as a result of competition for food and space, may also occur (similar to that described by Nagle, 1968).

Intense predation of phytal animals by fish would also explain Mukai's (1971) findings that the abundance of animals not only increased with the biomass of algae during winter but that numbers per unit surface area also greatly increased at the same time. The mortality caused by predators over the winter months may have been considerably lower than the rates of increase of phytal animals, allowing population levels temporarily to escape predatory controls.

In summary, the most likely hypothesis to explain the observed seasonal flux in fauna at Fancy Point involves epiphytic growth regulating the dynamics of the phytal community. The low number of grazers present during the winter months cannot control a burst of productivity of filamentous algae as light

levels increase in spring and early summer. Animal numbers rise during the summer months in response to the considerable habitat heterogeneity and production of epiphytes, but, as these resources are removed by grazers in autumn, predation and lack of recruitment reduce the number of invertebrates to the comparatively low winter and spring levels. These events occur independently of the phenologies of the macro-algae at Fancy Point. However, animal densities would probably follow variation in the biomass of macrophytes in regions with considerable changes in standing crop. Similar fluctuations to those discussed here would be expected in other temperate environments which are sufficiently sheltered to allow considerable epiphytic growth.

CHAPTER 4: FACTORS AFFECTING THE DISTRIBUTION OF AMPITHOID AMPHIPODS

4.1 INTRODUCTION

Very few studies of competition have been undertaken in the phytal environment, despite the possibility of diffuse interspecific competition for food and space as a result of the relatively minor spatial separation of animals between different algal species which was shown in the preceding chapters. One method widely used by ecologists to gain inferential information on the mechanisms of competition has been the observation of differences in resource partitioning between closely-related species (Schoener, 1974; Hines, 1982).

Amphipods belonging to the genera Ampithoe and Cymadusa (Family Ampithoidae) have few morphological differences and have been found abundantly in most of the investigated algal and seagrass environments throughout the world (Nagle, 1968; Bousfield, 1973). Seven species within these two genera were found to be common within the semi-exposed Fancy Point study site. Four of these species were also extremely abundant at the nearby site with greater shelter, and were found to have seasonal peaks of abundance at approximately the same time of year (December to March).#

This chapter differs from the previous two, which were largely descriptive, in attempting to deduce the mechanisms which caused the

---

#Unfortunately, these four ampithoid species are presently undescribed and are referred to as Cymadusa sp. 1, Ampithoe sp. 1, Ampithoe sp. 2 and Ampithoe sp. 3. Voucher specimens of these amphipods have been lodged at the Tasmanian Museum and Art Gallery (Registration numbers G2626, G2623, G2624, G2625).

distribution patterns of the Fancy Point ampithoids. The investigation was aimed primarily at determining whether the four species exhibited resource partitioning, or whether the species were able to coexist because of an oversupply of food resources during the period of their maximum abundances in late summer when interspecific competition would normally be expected to be greatest. A second aim of the study was to determine whether the distribution patterns of one of these species (Cymadusa sp. 1) resulted from the selection of particular algae by individuals, or was caused by the random settlement of animals among algae and the differential mortality of amphipods as a result of selective predation by fish. An underlying assumption of the former hypothesis is that movement of phytal amphipods must occur between algal species during the animals life-cycles because large individuals were found predominantly on wide-bladed plants while smaller animals were found on more filamentous algae. The latter hypothesis could only hold if phytal animals rarely redistributed themselves amongst plants.

Thus, some knowledge about the mobility of phytal animals between plants was necessary for a discussion of the aims of the study. The literature, however, contains conflicting reports on the mobility of phytal amphipods. Skutch (1926), for example, showed that in the laboratory Ampithoe rubricata would not leave its constructed tube over a period of three days to feed on Ulva only 3 inches distant, while Ledoyer (1969) found that Cymadusa crassicornis migrated onto the stems of Posidonia at night and Makkaveeva (1979) deduced that Ampithoe vallanti swam nocturnally in the water column. Consequently, sampling over a 24 hour period and settlement experiments were undertaken to directly determine the mobility of phytal animals at Fancy Point.

4.2 METHODS

4.2.1 Distribution of amphipods among algae

The monthly collection and sorting of phytal animals at Fancy Point has been described in the previous chapter. Five different species of macro-algae (Caulocystis cephalornithos, Cystophora retroflexa, Sargassum bracteolosum, Sargassum verruculosum and Zonaria turneriana) were collected in the first week of each month from July 1978 to June 1979 and the composition of the associated macrofauna determined. Specimens of Cymadusa sp. 1, Ampithoe sp. 1, Ampithoe sp. 2 and Ampithoe sp. 3 were measured from the centre of the eye to the distal edge of the fifth coxal plate using a dissecting microscope with an ocular grid. This distance was relatively independent of the degree of flexion of the animals and was more accurately measured than the smaller body dimensions such as head width. It was also approximately half the total length and hence will be referred to as the half length. Length-frequency histograms were constructed from these measurements for the four ampithoids associated with each algal species in each month. When the number of animals per algal species per month greatly exceeded 100, subsamples of approximately 100 individuals were measured and the size-frequency histograms estimated using this information and density data.

4.2.2 Algal Preference Experiments

A series of three algal selection experiments was carried out to investigate the effects of crowding and amphipod size on the distribution of Cymadusa sp. 1. The numbers of amphipods nestling amongst Sargassum verruculosum, Sargassum bracteolosum, Cystophora retroflexa and Zonaria turneriana were recorded after animals had been released into the centre of 12cmx18cm plastic containers (7cm water depth) with blades of the different algal species in the four quadrants. Amphipods were released at 2.00 p.m. and counted at 11.00 a.m. the next day. All animals were extracted from algae collected at Fancy Point and were used only once in selection experiments. A few individuals were found to have died during the course of the experiments. These trials were excluded from the results and the replicates repeated. The experiments were as follows:

Experiment 1 (Size). Two individuals of small (less than 2.5mm total length), medium (total length between 2.5mm and 6mm) or large (greater than 6mm total length) size-classes of amphipods were placed into containers with 50 cm^2 blades of each of the four algal species. The treatments were replicated 15 times.

Experiment 2 (Crowding). Differing numbers of medium sized amphipods were placed into containers with 50cm^2 blades of each of the algae. The abundances of animals in these trials (with the number of replicates in parentheses) were 10 (7), 5 (7), 2 (15) and 1 (20).

Experiment 3 (Crowding). 5 large and 5 medium sized amphipods were placed together into 18cmx18cm containers (8cm water depth) with either 50cm^2 or 250 cm^2 blades of each of the algae. The treatments were replicated seven times.

Differences between the algal preferences of animals in the experiments were tested for significance using the χ^2 contingency test.

4.2.3 Predation Experiments

The predatory efficiency of the omnivorous fish Acanthaluteres spilomelanurus (Family Monacanthidae) amongst different algae and with two different prey sizes was tested in the laboratory. This species was chosen for experimentation as both Cymadusa sp. 1 and Ampithoe sp. 1 were included as minor components of its diet at Fancy Point (Table XVIII) and specimens were readily captured in fish traps at that site.

One hour prior to each experiment, ten amphipods (Cymadusa sp. 1) of either small (less than 4mm total length) or large (greater than 8mm total length) size were introduced into 20cmx45cm aquaria (23cm water depth). These glass tanks were either bare or contained thalli of Zonaria or Cystophora with standardized surface areas of 500cm^2. A single Acanthaluteres was allowed to forage undisturbed for two hours and the number of surviving amphipods at the end of that period counted. All fish were used only once and were starved for four days prior to the trial but then fed a single amphipod immediately before the experiment to induce feeding.

Each experimental treatment (3 substratum types x 2 prey sizes) was replicated 5 times and the differences between treatments tested for significance using the standard normal deviate calculated by the non-parametric Wilcoxon-Mann-Whitney Test (Steel & Torrie, 1980).

4.2.4 Diel Fluctuations in Amphipod Abundance

Diel changes in phytal amphipod abundances were investigated by collecting quantitative algal samples at Fancy Point over a 24 hour cycle. Six plants (3 Caulocystis cephalornithos and 3 Zonaria turneriana) were individually enclosed within plastic bags at two hourly intervals from 11 a.m. 22 June 1981 to 11 a.m. 23 June 1981. Macrofaunal animals were preserved, extracted and sorted using the procedures described previously.

At the same time as faunal samples were collected, water temperatures and salinities (measured using an Autolab Model 602) and O_2 concentrations (measured by YSI Model 57 oxygen meter) were recorded with the aid of probes lowered to 10cm above the reef surface. Tidal height was also measured using a calibrated ruler placed vertically near the shore.

4.2.5 Settlement of Amphipods

Artificial algae were placed underwater on the reef at Fancy Point between 25 March and 26 May 1982 and re-collected within plastic bags for faunal determinations after periods of 1, 15 and 62 days. Two types of substratum were used, each with approximately the same surface area ($600cm^2$). Artificial algae were either 'filamentous', consisting of 156 strands of 20cm long 0.6mm diameter monofilament fishing line, or 'flat', consisting of 30 strips of 1cmx10cm nylon cloth. The elements of both algal types were bound at one end with twine and were attached to individual paving bricks. Three replicates of the two algal types were used for each time period.

A second settlement experiment consisted of detaching eight reproductive axes of Sargassum verruculosum on 25 May 1982, completely removing the phytal fauna by washing the plants in a 50% ethanol solution, and then reattaching the axes to the original holdfasts with twine. These reproductive axes were then re-collected 24 hours later and the fauna which had colonized the fronds were extracted and sorted. A single plant was also defaunated as a control using the same techniques and then left overnight in a plastic bag within the study area to determine whether animals remained on the frond despite the defaunation treatment.

4.3 RESULTS

4.3.1 Distribution of Amphipods among Algae

The life-cycles and distribution patterns of the ampithoid species are discussed individually below with reference to Table XIX and Figs 18 and 19. The estimated densities of the four species per square metre of reef substratum for each alga and month (Table XIX) were calculated assuming that Caulocystis cephalornithos occurred at a constant density of 5.76 plants per square metre, Sargassum verruculosum at 2.24 m^{-2}, Sargassum bracteolosum at 5.44 m^{-2}, Cystophora retroflexa at 2.08 m^{-2} and Zonaria turneriana at 14.4 m^{-2} (Table XII).

Cymadusa sp. 1: Recruitment of juvenile Cymadusa to the population occurred primarily from November to March and cohorts appeared to increase at a rate of approximately 0.5mm half length per month at this time (Fig. 18). It is likely that several cohorts per female were produced during the year on the evidence of the lack of well defined size classes, long period of recruitment

Table XIX. Estimated densities per m^2 reef surface of animals associated with different algae in different months.

Cymadusa sp. 1

Algal Species	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Sargassum bracteolosum	152	54	196	174	724	1621	3868	2171	3416	1860	511	506
Sargassum verruculosum	60	54	273	1160	486	105	278	396	1552	1360	1384	1272
Caulocystis cephalornithos	184	156	645	899	2805	2114	3928	2897	2926	3681	2851	3156
Cystophora retroflexa	144	25	139	200	551	160	926	349	907	732	535	275
Zonaria turneriana	259	187	115	216	101	216	130	950	533	691	821	187

Ampithoe sp. 1

Algal Species	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Sargassum bracteolosum	903	424	267	190	163	544	636	789	821	408	588	473
Sargassum verruculosum	235	148	233	186	204	52	90	155	594	551	545	703
Caulocystis cephalornithos	1423	732	357	380	628	1423	1135	893	2719	904	1642	1901
Cystophora retroflexa	724	279	60	64	62	100	87	50	154	83	449	408
Zonaria turneriana	173	130	115	58	14	0	0	43	29	58	144	58

Table XIX (Cont.).

Ampithoe sp. 2

Algal Species	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Sargassum bracteolosum	60	5	5	16	11	125	1376	549	288	5	11	11
Sargassum verruculosum	25	20	4	9	36	11	4	16	20	20	43	27
Caulocystis cephalornithos	109	58	11	11	69	265	167	115	276	104	46	86
Cystophora retroflexa	0	15	2	0	6	0	0	0	0	2	8	8
Zonaria turneriana	0	0	0	0	0	0	0	0	14	0	0	0

Ampithoe sp. 3

Algal Species	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Sargassum bracteolosum	441	163	288	593	136	1507	914	397	196	109	327	38
Sargassum verruculosum	2	0	2	31	0	4	0	0	7	2	2	2
Caulocystis cephalornithos	0	6	0	6	6	0	0	0	0	0	0	0
Cystophora retroflexa	10	6	0	0	4	8	4	4	0	0	4	4
Zonaria turneriana	0	0	0	0	0	0	0	0	0	0	130	0

Fig. 18. Monthly size-frequency histograms showing estimated densities (m^2 reef substratum) of the half length size classes of four ampithoid amphipod species.

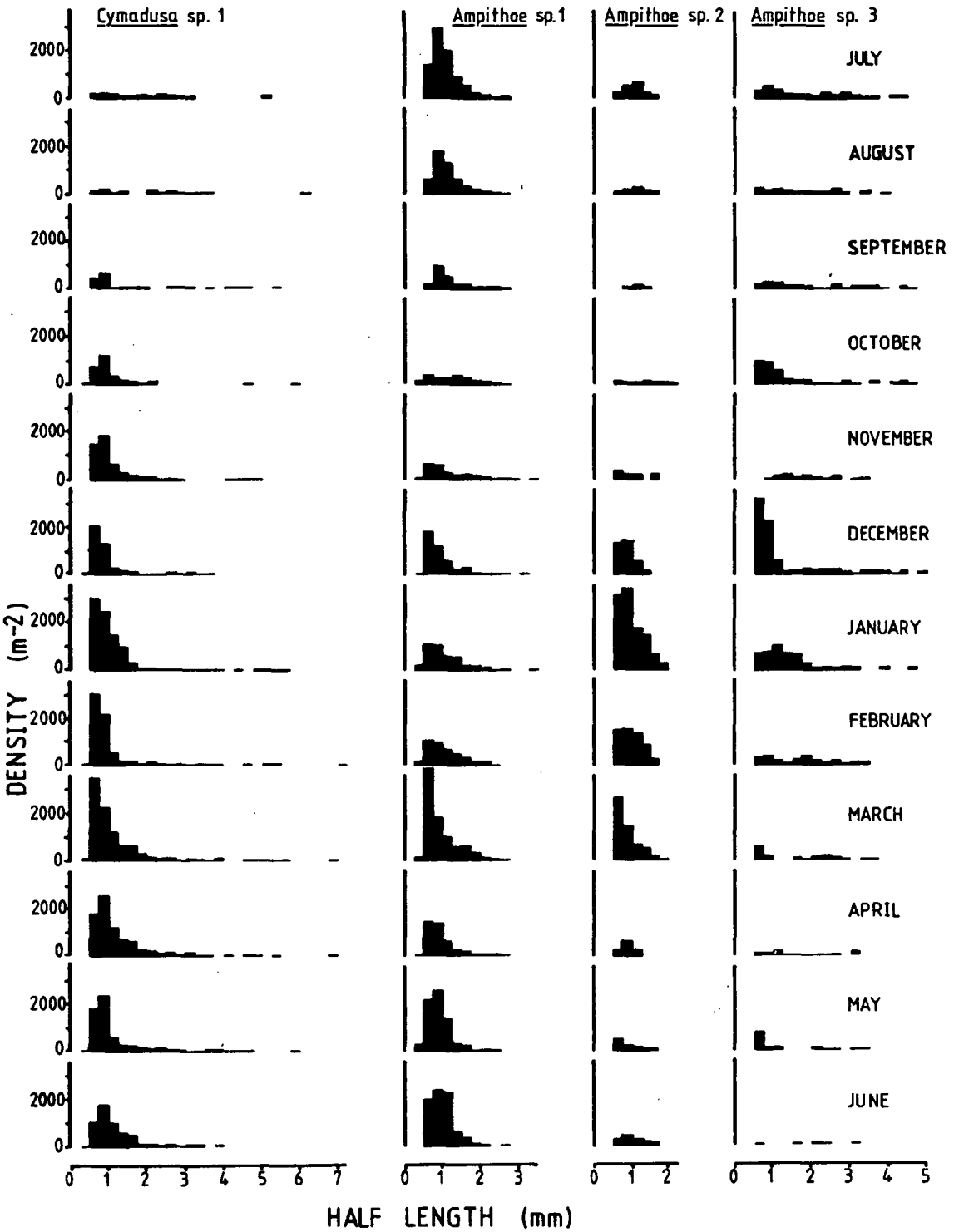
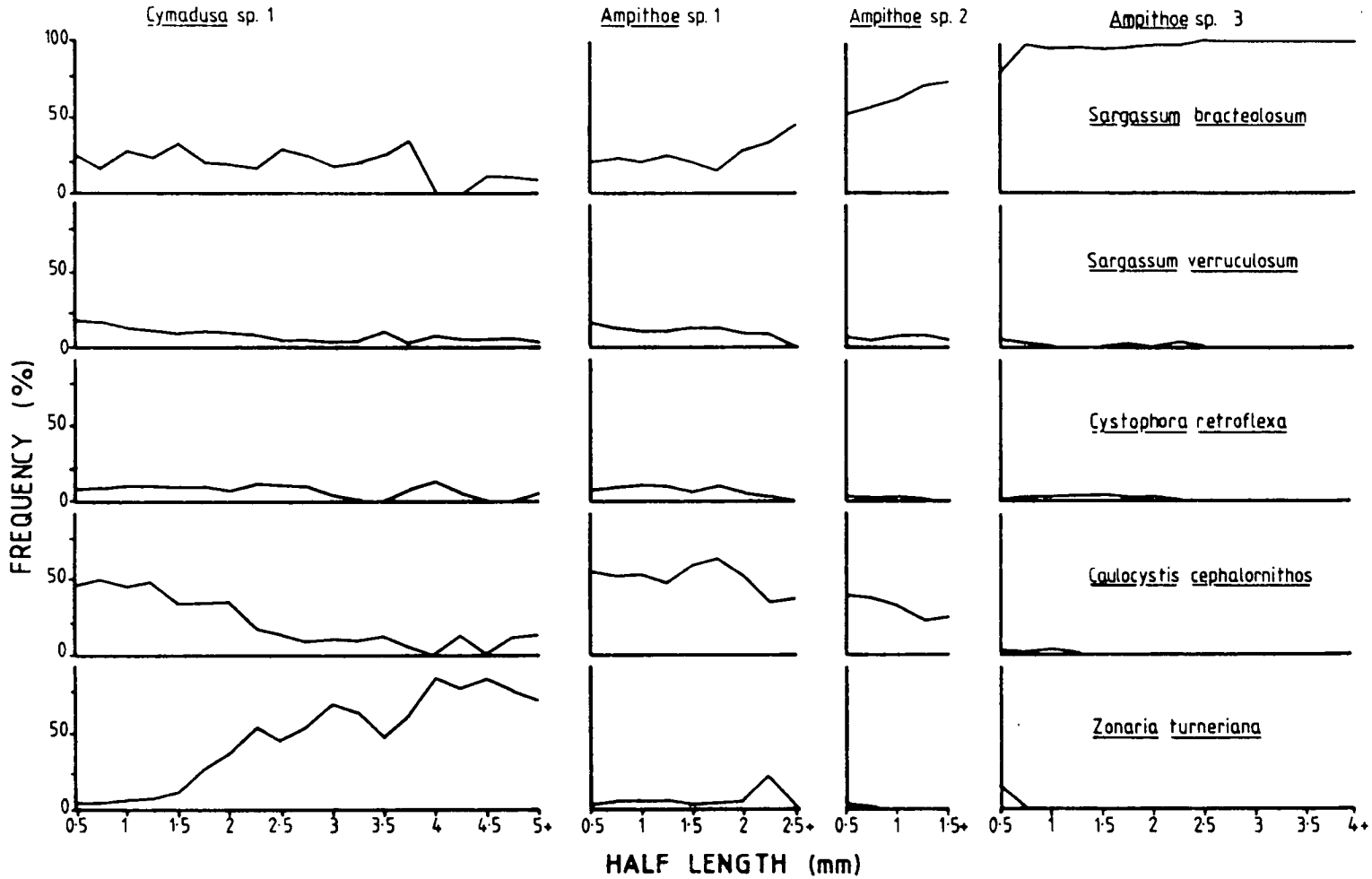

Cymadusa sp. 1
Ampithoe sp.1
Ampithoe sp. 2
Ampithoe sp. 3
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
2000
0
DENSITY (m-2)
0 1 2 3 4 5 6 7
0 1 2 3
0 1 2
0 1 2 3 4 5
HALF LENGTH (mm)

Fig. 19. Abundances of the half length size classes of four ampithoid amphipod species on different plants expressed as percentages of total abundance for each size class.


Cymadusa sp. 1
Ampithoe sp. 1
Ampithoe sp. 2
Ampithoe sp. 3
Sargassum bracteolosum
Sargassum verruculosum
Cystophora retroflexa
Caulocystis cephalornithos
Zonaria turneriana
FREQUENCY (%)
HALF LENGTH (mm)

and the presence of ovigerous females in samples collected in all months of the year except March. Adults occurred in the population throughout the year and showed much better survival over the winter months than juveniles. Even though Cymadusa occurred abundantly on all algae, the size classes of animals on various species were markedly different (Fig. 19) with adults being predominant on the wide-bladed Zonaria and immature animals generally associating with the more filamentous Caulocystis. The proportional abundance of Cymadusa on S. bracteolosum was relatively independent of the size of the animals. The low numbers of juvenile Cymadusa at Fancy Point during the winter months resulted in the occurrence of the greatest abundances of animals at that time on Zonaria, but in other months of the year maximal abundances of animals were present on Caulocystis.

Ampithoe sp. 1: This species showed a similar annual life-cycle to Cymadusa but had a more constant population structure (Fig. 18), probably because of the longer and more regular period of recruitment. Ovigerous females were collected in all months of the year. Ampithoe sp. 1 was widely distributed among algae, particularly erect species. There was little evidence for the existence of differences in the size-structure of populations on different algae, apart from a slightly greater proportional abundance of large animals being associated with S. bracteolosum.

Ampithoe sp. 2: The life-cycle of Ampithoe sp. 2 was primarily influenced by the growth of reproductive fronds on S. bracteolosum from November to March. The association of this species with S. bracteolosum is evident in Table XIX and its presence on reproductive fronds can be deduced from data derived from seven plants collected on 9 March 1981 when the animals on the basal and reproductive fronds were enclosed separately in plastic bags. The mean number (± standard deviation) of Ampithoe sp. 2 on the reproductive

fronds was 11.3 (±9.9) and on the basal fronds 0.9 (±1.1). This compares with an average of 0.7 (±1.9) Ampithoe sp. 3 on the reproductive fronds and 7.7 (±7.9) individuals on the basal fronds. Recruitment of juvenile Ampithoe sp. 2 to the population occurred almost exclusively during summer. Mortality was very high in April, the month immediately after the reproductive fronds of S. bracteolosum disappeared. Most of the surviving animals were collected from Caulocystis at that time.

Ampithoe sp. 3: This species was closely associated with the basal fronds of S. bracteolosum. The major cohort of juveniles entered the population in December but minor recruitment also occurred in other months of the year (particularly October). The December cohort was lost from the population in March and grew at a similar rate to Cymadusa (approximately 0.5mm per month).

The algal environment at Fancy Point was thus partitioned by the adults of the four ampithoid species. Cymadusa sp. 1 was associated with Zonaria, Ampithoe sp. 2 with the reproductive fronds and Ampithoe sp. 3 with the basal fronds of S. bracteolosum, and Ampithoe sp. 1 was widely distributed amongst all erect algae (particularly Caulocystis). The reliance of Ampithoe sp. 2 and Ampithoe sp. 3 on one algal species did not extend to the nearby semi-exposed Fancy Point site (with greater algal diversity) where Ampithoe sp. 2 was also collected abundantly from Sargassum decipiens, Cystophora moniliformis, Acrocarpia paniculata and Caulocystis cephalornithos, and Ampithoe sp. 3 from Cystophora torulosa and Carpoglossum confluens.

The ampithoid guild was partitioned by size as well as by algal species. Ampithoe sp. 2 grew to a maximum size of 2 mm half length, Ampithoe sp. 1 to 3.3 mm, Ampithoe sp. 3 to 4.8 mm and Cymadusa sp. 1 to 7.0 mm. This size range represented a relatively constant difference of ≃150% in the maximum sizes of the species.

4.3.2 Algal Preference Experiments

Medium-sized Cymadusa sp. 1 showed similar algal preferences to large animals (χ^2=0.99) but highly significant differences to small animals (χ^2=32.5, p<0.001) (Table XX). Juveniles preferred the finely branched algae S. verruculosum and Cystophora while adults chose the wide thalli of Zonaria and, to a lesser extent, S. bracteolosum. Thus, the observed patterns of distribution of Cymadusa sp. 1 in the field largely reflect algal selection by amphipods.

The preferences of amphipods subjected to different levels of crowding (Table XXI) did not differ significantly. Nevertheless, an increasing proportion of animals was found to move away from Zonaria to S. bracteolosum and then to the other algae as crowding increased. Further replicates would almost certainly have resulted in the χ^2 values becoming significant. A comparison of the preferences of animals crowded at 10 per trial with the sum of the amphipod preferences in the other three trials resulted in a χ^2 value of 12.6 (p<0.01).

In the second crowding experiment, animals were found to show a significantly greater preference for Zonaria when present in low densities (Table XXII). This occurred for both large (χ^2 =19.8, p<0.001) and medium-

Table XX. The numbers (and proportions) of Cymadusa sp. 1 of different sizes selecting each of four algal species with similar surface areas (50 cm^2). 2 amphipods were present in each replicate.

Algal Species	Size		
	Large	Medium	Small
Zonaria turneriana	16 (0.53)	15 (0.50)	3 (0.10)
Sargassum bracteolosum	9 (0.30)	12 (0.40)	2 (0.07)
Sargassum verruculosum	2 (0.07)	1 (0.03)	11 (0.37)
Cystophora retroflexa	3 (0.10)	2 (0.07)	14 (0.47)

Table XXI. The numbers (and proportions) of medium-sized Cymadusa sp. 1 selecting each of four algal species with similar surface areas (50 cm^2) when animals were present at different densities.

Algal Species	Number of Animals per Trial			
	10	5	2	1
Zonaria turneriana	35 (0.50)	22 (0.63)	15 (0.50)	15 (0.75)
Sargassum bracteolosum	18 (0.26)	12 (0.34)	12 (0.40)	5 (0.25)
Sargassum verruculosum	9 (0.13)	1 (0.03)	1 (0.03)	0
Cystophora retroflexa	8 (0.11)	0	2 (0.07)	0

Table XXII. The numbers (and proportions) of Cymadusa sp. 1 selecting each of four algal species with similar surface areas in trials with two different algal sizes. 5 large- and 5 medium-size amphipods were present in each replicate.

	Surface Area of Algae			
	250 cm^2		50 cm^2	
Algal Species	Amphipod Size		Amphipod Size	
	Large	Medium	Large	Medium
Zonaria turneriana	31 (0.89)	22 (0.63)	15 (0.43)	17 (0.49)
Sargassum bracteolosum	1 (0.03)	3 (0.09)	17 (0.49)	11 (0.31)
Sargassum verruculosum	2 (0.06)	3 (0.09)	2 (0.06)	6 (0.17)
Cystophora retroflexa	1 (0.03)	7 (0.20)	1 (0.03)	1 (0.03)

sized (χ^2=10.7, $p<0.05$) amphipods but was much more significant for the larger animals. The experiment also showed that medium-sized amphipods were not expelled from Zonaria by the larger animals at high densities (χ^2=3.41).

4.3.3 Predation Experiments

The mean number of animals eaten in each of the predation trials is shown in Table XXIII. Significantly greater numbers of amphipods were consumed by fish foraging amongst Cystophora than amongst Zonaria for both small and large sized animals. The number of large prey eaten while residing on Cystophora was similar to the number of prey detected and eaten within the open tank, indicating that Cystophora provided little cover for large animals. Small animals, however, were provided with some protection by Cystophora.

No differences were detected between the number of small or large prey eaten from among Zonaria (or the open tank) but large animals were eaten in significantly greater amounts from Cystophora.

4.3.4 Dispersal of Amphipods

Fluctuations in tidal height, water temperature and air temperature during the 24 hour sampling period are shown in Fig 20. Variations in salinity were minor (33.12‰ to 33.46‰.) and would not have affected phytal species. Oxygen concentrations ranged from 8.8 p.p.m. at 11 a.m. to 7.2 p.p.m. at 1 a.m. Sunset occurred at 4.43 p.m., moonrise at 9.50 p.m. and sunrise at 7.44 a.m.

Table XXIII. Mean number of animals (± standard deviation) consumed by fish in predation trials. Bars indicate non-significant differences ($p<0.05$) between treatments as determined by the Wilcoxon-Mann-Whitney Test.

Amphipod Size	Substratum Type		
	Algae Absent	Cystophora	Zonaria
Small	8.6±1.3	4.2±2.6	0.8±0.5
Large	8.0±1.9	7.4±2.5	2.0±1.2

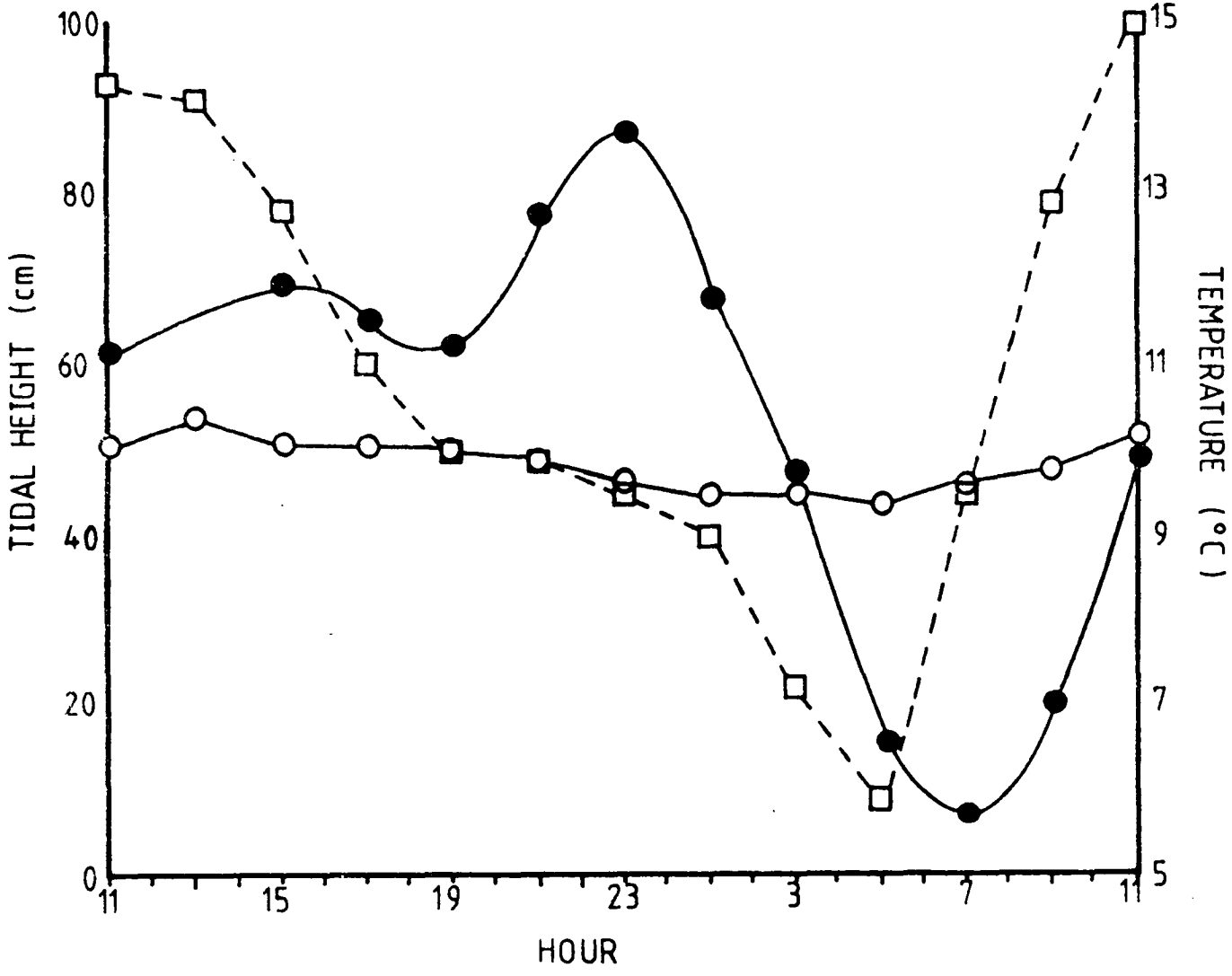


Fig. 20. Diel fluctuations in air (open squares) and water (open circles) temperatures and tidal height (closed circles).

The mean abundances of the common phytal species collected in the two-hourly samples are listed in Appendix 1. Diel fluctuations in the densities of amphipods per gram algal weight (Fig. 21) were difficult to determine, partly because of considerable variability between replicates. Nevertheless, the densities of amphipods on Zonaria appeared to decrease at night. In order to reduce the variability between replicates, samples from 1 p.m. to 5 p.m. were grouped, as were samples from 7 p.m. to 11 p.m., 1 a.m. to 5 a.m. and 7 a.m. to 11 a.m. (Table XXIV). Amphipods associated with S. verruculosum did not fluctuate significantly in abundance through the day but some amphipods clearly moved away from Zonaria at nightfall. Ampithoe sp. 1 was one of the species showing a reduction in the numbers associated with Zonaria at night. The daily pattern of movement of Cymadusa sp. 1 was difficult to determine because of low amphipod densities but regular changes were not apparent. The very low numbers of Ampithoe sp. 2 and Ampithoe sp. 3 precluded investigation of diel density changes in these species.

Results of the settlement experiments indicated that movement of phytal animals (including Ampithoe sp. 1 and Cymadusa sp.1) occurred between plants. Filamentous artificial algae were poorly colonized over the first two weeks compared with flat algae, but had much greater densities of animals at the end of two months (Table XXV). Ampithoe sp. 1 and Cymadusa sp. 1 were typical of the amphipods in not recruiting to filamentous artificial algae in any numbers for the first two weeks, but Cymadusa recruited to flat artificial algae during this time. The filamentous 'algae' possibly needed a conditioning period before animals would settle. Cymadusa showed much faster colonization rates than Ampithoe sp. 1 on both types of artificial substrata, and also on defaunated S. verruculosum (Table XXVI).

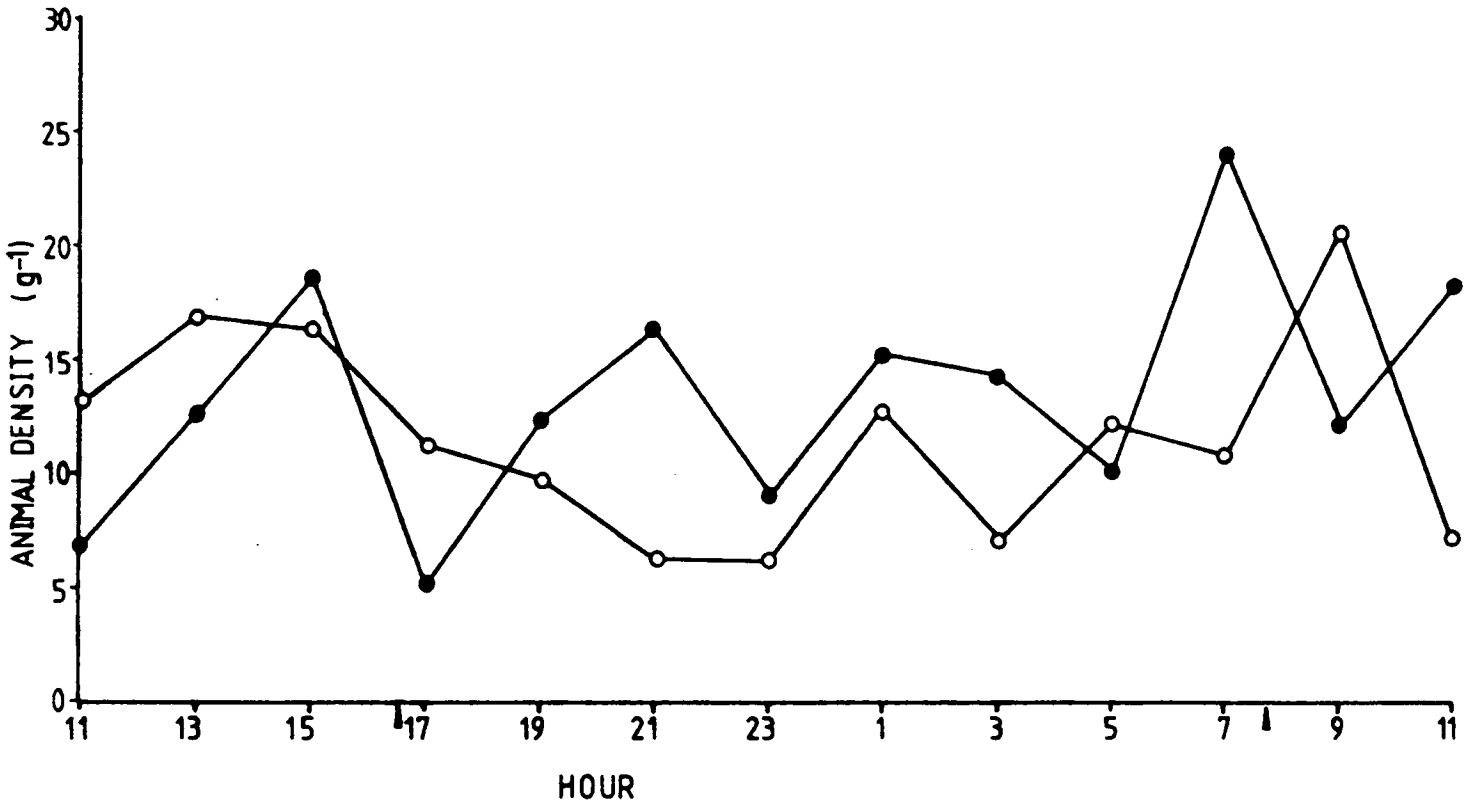


Fig. 21. Diel fluctuations in the densities of amphipods (per gram dry weight of algae) associated with Sargassum verruculosum (closed circles) and Zonaria turneriana (open circles).

Table XXIV. Mean densities of animals (± standard deviation) associated with two species of algae collected at different times of the day.

Total Animals

Algal Species	1-5 p.m.	7-11 p.m.	1-5 a.m.	7-11 p.m.
Sargassum verruculosum	43.5±25.1	65.4±27.1	57.4±28.4	62.3±31.6
Zonaria turneriana	57.5±21.8	53.9±31.4	71.6±38.7	63.9±21.5

Total Amphipods

Algal Species	1-5 p.m.	7-11 p.m.	1-5 a.m.	7-11 p.m.
Sargassum verruculosum	12.1±7.4	12.6±5.2	13.2±7.7	15.3±10.1
Zonaria turneriana	14.8±9.8	7.4±6.1	10.7±4.6	13.0± 7.4

Cymadusa sp. 1

Algal Species	1-5 p.m.	7-11 p.m.	1-5 a.m.	7-11 p.m.
Sargassum verruculosum	0.42±0.44	0.68±0.75	1.41±0.62	1.03±0.97
Zonaria turneriana	0.49±0.23	0.95±2.08	0.56±0.58	0.55±0.67

Ampithoe sp. 1

Algal Species	1-5 p.m.	7-11 p.m.	1-5 a.m.	7-11 p.m.
Sargassum verruculosum	2.41±1.84	3.47±1.73	3.40±2.63	3.23±2.17
Zonaria turneriana	1.11±0.87	0.34±0.72	0.44±0.73	1.36±1.72

Table XXV. Mean abundances of animals (± standard deviation) collected from filamentous and flat artificial algae after differing periods of submergence.

	1 Day		15 Days		62 Days	
	Filamentous	Flat	Filamentous	Flat	Filamentous	Flat
Total Animals	6.0±1.7	14.0±8.9	42.0±17.7	48.3±12.7	217±75.3	93.3±29.7
Total Amphipods	0.7±0.6	3.3±1.2	8.0±4.6	12.0±7.5	111±48.1	39.7±14.5
Ampithoe sp. 1	0	0	0.7±1.2	0	7.3±2.5	0.7±1.2
Cymadusa sp. 1	0.3±0.6	0.3±0.6	1.7±0.6	6.7±2.5	21.7±20.3	11.0±2.6

Table XXVI. Mean abundances of animals (± standard deviation) collected from S. verruculosum axes before and after defaunation.

	Pre-defaunation	Post-defaunation
Total Animals	372±179	4.75±3.54
Total Amphipods	99.9±43.9	3.13±1.89
Cymadusa sp. 1	6.9±16.5	0.50±0.76
Ampithoe sp. 1	35.5±16.5	0.63±0.74

Eleven individuals of the polychaete Exogone gemmifera were extracted from the single defaunated plant which had been enclosed within a plastic bag as a control. Faunal contaminants were not considered to have affected results, however, because the Exogone were recognizably partly decomposed and no Exogone were collected from the defaunated plants used as samples. It is likely that dead polychaetes were present when defaunated algae were placed in the field but were probably dislodged by wave action before collection the next day.

Approximately 2% of the original population of Ampithoe sp. 1, 7% of the original population of Cymadusa sp. 1 and 3% of the total original amphipod fauna recolonized defaunated algae overnight. The total number of phytal species collected from defaunated plants (12) represented 30% of the total number of species collected in the pre-defaunation samples. Thus, the mobility of the ampithoids was not exceptional for phytal species.

4.4 DISCUSSION

4.4.1 Dispersal

A number of recent studies on demersal zooplankton (e.g. Alldredge & King, 1980; Hammer, 1981) have shown that considerable numbers of infaunal amphipods enter the water column at night. A proportion of phytal amphipods at Fancy Point probably also swim during the night as many of the phytal species were closely related to the nocturnally migrating infaunal taxa, and Fincham (1974) found that 80% of amphipods collected by light trap in New Zealand were algal-dwelling species. Furthermore, Jansson & Kallander (1968) showed that activity of the phytal amphipod Gammarus oceanicus occurred primarily at night

and two extremely abundant taxa of amphipods at Fancy Point (Paradexamine churinga and a species of Tethygeneia) have been commonly collected in seagrass beds by nocturnal plankton tow (Robertson & Howard, 1978). The 24 hour sampling program, however, did not detect either a nocturnal decrease in the abundance of animals on S. verruculosum, as would be expected if most animals entered the water column, or a migration of benthic animals onto plants at night similar to that reported by both Ledoyer (1964, 1969) and Montouchet (1979).

The absence of detectable changes in the densities of animals could nevertheless be explained if (i) the number of swimming or migrating amphipods was disproportionately low on the night which was sampled, (ii) only a small proportion of animals swim on any night, or (iii) animals entered the water column for only a short period. Settlement experiments indicated that the second alternative, possibly in conjunction with the third, was most probable as amphipod recolonization rates were estimated at about 3% per day. This figure should be treated as an extremely approximate underestimate, however, because the experimental substrata differed from living algae and may have been rejected by some of the potential colonists, and the proportion of animals which swim on any night would partly depend on environmental conditions such as wave action or the phase of the moon (Fincham, 1974).

The ampithoids showed rates of movement amongst plants similar to the other amphipod species, with Cymadusa sp. 1 recolonizing at a rate of $\simeq$7% per day and Ampithoe sp. 1 at the less rapid rate of $\simeq$2% per day. Both small and large Cymadusa were found to disperse regularly between plants; the half lengths of animals on artificial substrata after 15 days ranged from 0.8 to 3.8 mm with a median size of 2.0 mm. The nine ampithoids collected on the defaunated plants were nevertheless all juveniles (less than 0.8 mm half

length) and it is possible that the small animals generally move by swimming and large animals by crawling in a similar way to that suggested for Ampithoe vaillanti by Makkaveeva (1979). Moreover, large Cymadusa sp. 1 were observed to crawl over the surface of Zonaria after dark in the laboratory.

The movement of Ampithoe sp. 1 away from Zonaria at nightfall (Table XXIV) may have resulted from animals leaving an unfavourable habitat when the opportunity arose at night. Ampithoe sp. 1 was much more abundant on algae with filament-like branches than on Zonaria (Table XIX) and the species also preferred filamentous to flat artificial algae (Table XXV). As morning approached, animals may have been forced to settle on nearby algae regardless of their favourability.

4.4.2 The Influence of Predation on Amphipod Distribution

The association of large amphipods with wide-bladed algae was previously suggested to result from the consumption of large animals associated with finely-branched algae by fish (see Chapter 2). Laboratory experiments confirmed that Acanthaluteres spilomelanurus was more efficient at detecting large, rather than small, prey residing on Cystophora retroflexa but was inefficient at detecting both size-classes on Zonaria turneriana. Although this fish is an omnivore, other fish with carnivorous diets might also be expected to show similar predatory patterns.

An indication of the relative mortality rates of amphipods at different sizes associated with the various algal species at Fancy Point is given in Table XXVII where the abundance of each size class has been expressed as a percentage of the the sum of the 0.5-0.75 mm and 0.75-1.0 mm size classes.

Table XXVII. Abundances of animals in different half length size classes expressed as percentages of the numbers of animals between 0.5 and 1.0 mm; Cymadusa sp. 1, C1; Ampithoe sp. 1, A1; Ampithoe sp. 2, A2; Ampithoe sp. 3, A3.

	S. bracteolosum				Caulocystis			Cystophora		S. verruculosum			Zonaria	
	C1	A1	A2	A3	C1	A1	A2	C1	A1	C1	A1	A2	C1	A1
0.50-0.75 mm	53.7	45.5	46.5	53.0	47.4	51.2	48.8	50.8	43.3	48.9	55.3	54.0	60.5	37.4
0.75-1.00 mm	46.3	54.5	53.5	47.0	52.6	48.8	51.2	49.2	56.7	51.1	44.7	46.0	39.5	62.6
1.00-1.25 mm	25.0	27.6	41.5	31.3	19.9	28.9	31.3	24.4	41.2	14.6	22.0	43.8	29.9	36.1
1.25-1.50 mm	12.3	15.7	21.4	14.6	11.4	12.3	9.3	13.1	17.9	7.4	10.7	19.7	19.2	19.7
1.50-1.75 mm	10.6	9.5	10.3	13.7	6.0	11.1	6.3	7.6	7.9	4.7	9.8	6.6	24.0	2.7
1.75-2.00 mm	2.7	2.5	3.9	13.1	2.2	4.8	0	2.9	5.2	2.0	4.1	0	20.3	2.7
2.00-2.25 mm	2.0	2.8	0	9.8	1.8	2.1	0.7	1.8	1.7	1.1	1.3	0	22.9	2.7
2.25-2.50 mm	0.8	1.6	0	9.2	0.5	0.6	0	1.7	0.3	0.5	0.6	0	17.3	5.4
2.50-2.75 mm	1.6	1.2	0	10.4	0.4	0.1	0	2.0	0.7	0.3	0.2	0	17.1	0
2.75-3.00 mm	0.8	0	0	5.9	0.1	0.1	0	0.8	0	0.2	0	0	10.9	0
3.00-3.25 mm	0.8	0	0	5.9	0.2	0.1	0	0.5	0	0.1	0	0	19.5	0
3.25-3.50 mm	0.4	0	0	4.8	0.1	0	0	0	0.7	0.1	0	0	9.1	0
3.50-3.75 mm	0.3	0	0	4.2	0.1	0	0	0	0	0.2	0	0	4.3	0
3.75-4.00 mm	0.6	0	0	2.1	0.1	0	0	0.4	0	0.1	0	0	6.1	0
4.00+ mm	0.3	0	0	6.9	0.2	0	0	0.4	0	0.4	0	0	2.5	0

Amphipod species with less than 30 individuals on a given algal species have not been included in this table as the size-frequency distributions of these animals were highly variable.

With the exceptions of Cymadusa sp. 1 on Zonaria and Ampithoe sp. 3 on S. bracteolosum, the population structures of the ampithoids both between algal species and between amphipod species were remarkably similar. This provides further evidence for the regular movement of animals among algae, because it is more likely that the similarity of the size-frequency distributions of animals between algal species resulted from the collection of subsamples of the total population structure for the study site, rather than reflecting similar, but independent, mortality events on each algae. The close agreement between the population structures of different amphipods on each plant indicate that size-dependent reductions in animal numbers were probably relatively independent of animal species. Thus, if predation was a major source of mortality among amphipods, then predators did not seem to distinguish greatly between ampithoid species as prey.

Animals with sizes ranging from 0.75 to 1.5 mm declined at a rate of ≃50% per 0.25 mm size class. The survival of 1.5 mm to 1.75 mm size class animals was very poor (≃65% mortality) but mortality rates then stabilized at a relatively low level (≃15%). The two ampithoid species showing exceptional mortality patterns (Cymadusa sp. 1 on Zonaria and Ampithoe sp. 3 on S. bracteolosum) were reduced at the same rates as the other species until 1.25 mm size but then decreased at a rate of ≃15% per size class and did not show the expected 65% reduction in abundance at 1.5 mm size. Some movement of Cymadusa sp. 1 from other algae to Zonaria at ≃1.5 mm size presumably occurred.

The most plausible hypothesis to explain the observed size-frequency distributions of ampithoid species is that mortality of animals less than 1.25 mm was primarily caused by environmental factors and/or predation by small, indiscriminate-feeding phytal animals but that selective visual predators external to the plant were capable of greatly reducing the numbers of the larger amphipods.

Predation by relatively small species such as shrimps, crabs and nereid polychaetes has been suggested to control infaunal amphipod numbers by Young et al (1976), Nelson (1979a) and Commito (1982). These animal groups were abundant phytal components at Fancy Point and may well have fed with little selectivity on amphipods of different species as they were encountered amongst the plants. Such predators would be restricted to prey below a certain size (Nelson, 1979a).

A reduction in animal abundances due to extreme environmental conditions seems a less probable explanation for the considerable mortality rates of the smaller amphipods although Fincham (1974) suggested that dislodgement of large numbers of algal-dwelling animals occurred in turbulent sea conditions. Fish predation of nocturnally-swimming amphipods provides a third possible mechanism for the decrease in numbers of small ampithoids.

The larger 'external' predators, primarily fish, are suggested to be highly efficient at detecting large amphipods (>1.5 mm half length) amongst finely branched algae at Fancy Point but inefficient at finding similarly-sized amphipods which are adapted for a cryptic existence amongst broad-leaved plants. In the seagrass environment, Stoner (1982) found Cymadusa compta to survive predatory fish more efficiently amongst the wide-bladed plant Thalassia testudinum than amongst finer leaved Halodule wrightii. The presence of a few large amphipods on Caulocystis and Cystophora at Fancy Point

indicates that a 'leakage' of these animals as adults probably has occurred from Zonaria and S. bracteolosum, even though selection experiments showed them to much prefer these species, rather than the animals surviving on the same plant from the juvenile stage.

Within such an environment subjected to different levels of predation, amphipods could adopt either of two possible reproductive strategies. Species could either reach maturity at a small size and produce large numbers of eggs before predation pressure completely eliminated the developing cohorts, or they could rely on a proportion of animals surviving the phytal predation period and have adults adapted by habit and camouflage to escape 'external' predators. The latter strategy appears to have been adopted by Cymadusa sp. 1 and Ampithoe sp. 3 at Fancy Point while the former was used by Ampithoe sp. 1 and Ampithoe sp. 2 (and all of the other common amphipods). It is interesting to speculate whether the low standing crop of Zonaria would allow amphipod species to use this plant as an adult refuge and maintain constant population levels if animals at all stages of development selected for Zonaria. Cymadusa sp. 1 may possibly have had insufficient numbers of recruits reaching 1.5 mm size if juveniles had associated with adults on Zonaria and no recruits migrated at this stage from other plants.

4.4.3 The Influence of Competition on Ampithoid Distribution

A question of prime importance to the discussion of competition amongst ampithoids is whether or not the considerable differences in the distribution patterns of the four species were directly related to the taxonomic and morphological similarity of these animals. Chance association seems unlikely as the specialized associations of both Ampithoe sp. 2 and Ampithoe sp. 3 with

S. bracteolosum were exceptional for phytal species at the sheltered Fancy Point site. All of the common amphipods, other than ampithoids, were not associated with particular plant species and were without abundant, closely-related, sympatric species. Two morphologically similar aorid species, Aora hircosa and Lembos sp. 1, were found to subdivide the vertical environment with Aora being primarily collected from among plant axes distal to the holdfast and Lembos being found near the reef substratum (pers. obs.).

Samples collected at the nearby semi-exposed Fancy Point site were analysed to determine whether amphipods with several co-occurring congeners had significantly restricted distribution patterns compared with species without close relatives. The dispersion index used was the F-value resulting from a one-way ANOVA of animal abundance per plant as the observations and algal species as treatments. For each of the species occurring in abundances greater than 50, the Spearman rank correlation coefficient relating the number of congeneric species with the dispersion index was found to be significant (r_s=0.29, n=34, $p<0.05$). A similar correlation between the dispersion index and the number of sympatric amphipod species within the family was not significant (r_s=0.15). Hence, the specialization of species apparently was related to the number of sympatric species within the genus but not with the more distantly related species within the family.

A second indication that the habitat partitioning between the ampithoids did not occur by chance was the constancy of the ratio between the maximum body sizes of the species. This ratio varied from 1.45 to 1.65 as compared to the ratio of 1.3 which was considered by Hutchinson (1959) to be indicative of the level required for the co-existence of ecologically similar species. Previous studies of marine amphipods of the genus Gammarus have also shown co-existing congeneric species to be partitioned by size (Steele & Steele, 1975; Kolding & Fenchel, 1979; Kolding, 1981), and Mills (1967) found that an

ampeliscid sibling species pair differed in maximum size by a ratio of 1.5. It should be noted, however, that populations of Cymadusa and Ampithoe have been found to occur sympatrically without obvious size partitioning by Gilat (1962) and Nelson (1980).

Strong circumstantial evidence thus suggests that competition between ampithoid species at Fancy Point would have occurred if the amphipods had had greater similarities in their life-histories. Whether this competition would have been for food or space remains highly speculative. Competition for space was implicated to occur among large amphipods at high densities in the laboratory (Tables XXI and XXII) but these densities (1 large Cymadusa per 10 cm^2 Zonaria) have not been recorded in the field.

Fenchel & Kolding (1979) have suggested that size and habitat divergence in Gammarus resulted from selection against interspecific precopulation formation leading to sterile matings. Similar "mating competition" could have occurred amongst the four ampithoid species at Fancy Point since sterile matings now would be largely prevented because of the size and habitat partitioning amongst adults. Moreover, it is notable that immature animals were not similarly partitioned. Small individuals of Cymadusa sp. 1, Ampithoe sp. 1 and Ampithoe sp. 2, for example, were each collected abundantly on S. bracteolosum reproductive fronds in March. Competition for food or space, however, would be expected to be relatively minor over autumn due to the pronounced growth of epiphytes. During the winter season of poor epiphytic growth the populations of amphipods showed much more distinct size and habitat specialization.

CHAPTER 5: PATTERNS OF SPECIES DIVERSITY

5.1 INTRODUCTION

The initial aim of this study was to determine the factors influencing the diversity of phytal animals in eastern Australia. To do this it was necessary to calculate diversity indices, rather than relying solely on the number of species per plant (the species density), because of the considerable variation in the size of sampled algae and consequently the number of animals associated with each plant. After calculating different indices, however, it became evident that the data from the earlier studies could be interpreted to show that (i) diversity increased with depth, (ii) diversity decreased with depth, (iii) diversity was positively correlated with epiphytic biomass, and (iv) diversity was negatively correlated with epiphytic biomass. The aim was therefore extended from an investigation into the factors influencing the diversity of phytal animals, to include an analysis of the more common diversity indices and to determine their usefulness in situations involving highly variable sample sizes.

During the past twenty years studies of diversity have evolved into distinct mathematical and biological streams with very few investigations during that time dealing with both of these aspects (one exception being the study of Sanders, 1968). The mathematically orientated approach has tended to involve the analysis of the properties of diversity indices, and the proposal of new ones (see Grassle et al, 1979). Field ecologists have been more interested in the causes of diversity, and generally rely on a few standard indices to describe a community of organisms and reduce it to one or two

variables. The mathematical aspects are usually ignored in these studies on the basis that different diversity indices are highly correlated (e.g. Hicks, 1980).

The most widely used indices of diversity are the total number of species within a sample (S), the Shannon-Wiener Information Index (H') (MacArthur, 1965), Simpson's Dominance Index (SI) (Simpson, 1949) and Pielou's Evenness (J) (Pielou,1966a). Hill (1973) found that these four measures were mathematically related and he proposed that the transformed indices N_1= exp(H') and N_2=1/SI were preferable to H' and SI because they follow Renyi's definition of a generalized entropy (which also includes the species density S(=N_0)), and N_1 can be thought of as the number of abundant species and N_2 as the number of very abundant species. He further recommended that N_1/N_0 and N_2/N_1 be used as evenness indices in preference to J (=ln[N_1]/ln[N_0]). Modifications to Hill's evenness indices, which were shown to be superior in situations with a low number of species, were proposed by Heip (1974) (N_1-1/N_0-1) and Alatalo (1981) (N_2-1/N_1-1). Pielou (1966b) had previously demonstrated that H' cannot be used in situations where every member of the community has been counted, and in this situation Brillouin's Index (H) is appropriate. In a critical study of diversity, Hurlbert (1971) also suggested alternative indices to H'; viz. HE = the proportion of interindividual encounters which is interspecific, and E(S_n) = the expected number of species in a random subsample of n individuals.

Other diversity indices which are occasionally used in ecological studies are Margalef's Index (Ma) (Margalef,1967), Menhinick's Index (Me) (Menhinick, 1964), McIntosh's Index (Mc) (McIntosh, 1967) and the Species Dominance Index (D) (Berger & Parker, 1970). Recently, Kempton & Taylor (1976) proposed a further index, Q, based on the slope of the cumulative species curve

in the mid-range of abundances, and it has been claimed that this index is better than others for discriminating between different communities (Kempton & Wedderburn, 1978).

A graphical procedure has also been used for comparing the diversities of communities. This involves the calculation of "rarefaction" curves to depict the number of species expected for any given number of individuals (Sanders, 1968; Simberloff, 1979). The original method used to calculate these curves has been shown to be incorrect and the appropriate methods are given by Hurlbert (1971) and Heck et al (1975).

Since diversity trends on a localised scale have not always been found to be reflected within a larger area (Jumars, 1976), the scale from which community information has been obtained is also of considerable importance. For convenience, diversity has been partitioned into different scales depending on how the investigator defines a habitat. The diversity within a habitat has been called the alpha diversity, differences between habitats the beta diversity and the total diversity of the system the gamma diversity (Whittaker, 1972). The present study has primarily been restricted to alpha diversity (the diversity of animal assemblages on individual plants).

Theories on the causes of diversity, particularly in reference to latitudinal gradients, are reviewed by Pianka (1966, 1974) and Rohde (1978) and invoke either physical or biological factors. The biological hypotheses are not discussed in the present study as they involve mechanisms such as predation (Paine, 1966) and competition (Dobzhansky, 1950) which have not been investigated but ultimately depend on physical factors within the environment. The major physical factors suggested to contribute to the diversity of communities are habitat heterogeneity, environmental stability and the level of nutrients (related to food resources and productivity).

The number of species within a habitat is now widely accepted to be closely related to the complexity of both physical and biological structures within the habitat (e.g. MacArthur, 1964; Abele, 1974; Luckhurst & Luckhurst, 1978). The effects of stability on diversity are much less clear because they are closely related to biogeographic processes, such as the dispersal of organisms, and need to be assessed on several different time scales. Pianka (1974) divided the stability hypotheses into three: (i) the evolutionary time hypothesis which assumes diversity increases with the age of the community by the speciation of organisms to fill available niches, (ii) the ecological time hypothesis whereby niches in disturbed habitats are not completely occupied because plants and animals do not have sufficient time to reinvade the habitat fully, and (iii) the climatic stability hypothesis which considers that few organisms can live in unstable environments where species need to have broad tolerance limits and consequently occupy broad niches. The contribution of nutrients to the diversity of systems is also problematical, with some authors claiming that productivity increases diversity (Connell & Orias, 1964) and others that it decreases diversity (Margalef, 1969). On the basis of computer simulations of simple non-equilibrium systems, Huston (1979) predicted that the greatest diversities would be found in areas of low productivity.

All three major physical factors suggested to influence diversity varied in a predictable manner within the phytal environment and were investigated in this study.

5.2 SAMPLING METHODS

The sampling and sorting methods used to collect algae and extract the motile macrofaunal animals have been described earlier and characteristics of the phytal assemblages at the two sites at Fancy Point given. These sites were both quite sheltered, but one locality at the end of a point had greater wave exposure and will be referred to as semi-exposed. Similar sampling and sorting procedures were also used to collect a further 15 algae from the exposed eastern coast of Bruny Island at One Tree Point (12 km. NNE of Fancy Point) on 10 November 1981. These samples comprised five plants of the elongate species Cystophora moniliformis from 1 metre below low water mark and an additional five replicates each of Cystophora and the comparatively small-sized Zonaria sp. from 6 metres depth.

Latitudinal trends in diversity indices were also assessed by using the same methods to collect five replicate samples of algal species at a further 14 sites along the east Australian coastline. Table XXVIII lists these sampling sites and the algae collected (further information is shown in Appendix 4). The algae investigated in this study were Sargassum spp. and Zonaria-like plants (Zonaria spp., Lobophora variegata (Lamouroux) Wom. and Padina spp.).

Table XXVIII. Sites where algal collections were made for latitudinal studies (additional to those at Bruny Island).

Locality	Latitude	Depth(m)	Algal Taxa Investigated
Lizard Island	14°40'	5	Padina tenuis
Wentworth Reef, Pt Douglas	16°31'	4	Sargassum (3 species), Padina tenuis, Lobophora variegata
Russel Island	17°14'	1	Padina tenuis
Magnetic Island	19°08'	3	Sargassum sp., Lobophora variegata
Slade Point, Mackay	21°05'	3	Sargassum sp., Padina tenuis
Yeppoon	23°08'	3	Sargassum sp. , Padina tenuis
Caloundra	26°48'	4	Zonaria sp.
Myora Light, Nth Stradbroke Island	27°30'	0.1	Sargassum sp.
Minniewater	29°47'	1	Sargassum sp., Zonaria sp.
Broughton Island	32°36'	3	Zonaria sp.
Halifax Point, Pt Stevens	32°42'	1	Sargassum sp.
Avalon	33°37'	5	Zonaria sp.
Mallacoota	37°34'	6	Zonaria sp.
Cape Portland	40°45'	3	Sargassum bracteolosum

5.3 RESULTS AND DISCUSSION

5.3.1 Comparison of Indices

The diversity and evenness indices investigated in this study are listed in Table XXIX. These indices were calculated for each of the 135 faunal samples at the semi-exposed Fancy Point site. Pearson correlation coefficients, which indicate the linearity of the relationships between these indices, are shown below the diagonals in the correlation matrices of Tables XXX and XXXI. Correlations relating the index Q to the other indices have not been included as this index cannot be calculated when the number of species is low. The number of species (S) was closely related to the number of individuals (N) as both were strongly influenced by algal weight. N was also positively correlated with Ma, and negatively correlated with Me, because species accumulated with sample size faster than ln N but slower than $\sqrt{N}$. All of the evenness indices were negatively correlated with animal abundance (N) at a highly significant level ($p<0.001$).

In order to reduce the variability caused by sample size, the correlation coefficients above the diagonal of the matrices given in Tables XXX and XXXI were calculated using the 60 samples having between 50 and 200 individuals.

The diversity indices can be divided into those sensitive to the species richness of the phytal assemblage (S, Ma, Me, Q), those sensitive to the dominance of the assemblage (SI, N_2, Mc, HE, D), and those falling between the other two groups (H', N_1, H). These three groupings are more clearly seen by relating the different indices to the $E(S_n)$ series of Hurlbert (1971) (Table XXXII). The expected number of species in a random subsample of 2 individuals

Table XXIX. Diversity and evenness indices investigated in this study.

Diversity

S = number of species

$H = (1/N)\ln \frac{N}{n_1!n_2!\ldots n_s!}$

$Ma = (S-1)/\ln N$

$E(S_n) = S-\binom{N}{n}^{-1} \sum_{i=1}^{S} \binom{N-n_i}{n}$

$SI = \Sigma p_i^2$

$N_1 = \exp(H')$

$H' = -\Sigma p_i \ln p_i$

$N_2 = 1/SI$

$Me = S/\sqrt{N}$

$Mc = 1-\Sigma p_i^2$

$D = p_{max}$

$Q = (S/2)\log(R_2/R_1)$

$HE = (N/N-1)(1-\Sigma p_i^2)$

Evenness

$J = H'/\ln S$

$E_{21} = N_2/N_1$

$E_{10} = N_1/S$

$E'_{21} = (N_2-1)/(N_1-1)$

$E'_{10} = (N_1-1)/(S-1)$

where N = total number of individuals

n_i = number of individuals of the ith species

n = number of individuals within the subsample

p_i = proportional abundance of the ith species

p_{max} = the maximum proportional abundance of any species

R_1 = lower quartile of the species- abundance distribution

R_2 = upper quartile of the species-abundance distribution

S_n = number of species in a subsample of n individuals

Table XXX. Pearson correlation coefficients relating diversity indices, the number of individuals and the number of species. Correlations below the diagonal were calculated from 135 samples with variable abundances. Correlations above the diagonal were calculated from 60 samples with between 50 and 200 individuals.

Index	N	S	H'	N_1	SI	N_2	H	Ma	Me	Mc	HE	D	Q
N	1	0.51	0.17	0.18	-0.15	0.11	0.31	0.27	-0.13	0.14	0.11	-0.12	0.00
S	0.72	1	0.84	0.84	-0.69	0.72	0.86	0.96	0.77	0.72	0.68	-0.61	0.74
H'	0.03	0.58	1	0.94	-0.95	0.89	0.99	0.90	0.86	0.97	0.95	-0.90	0.70
N_1	-0.02	0.55	0.94	1	-0.82	0.97	0.93	0.90	0.86	0.89	0.82	-0.82	0.72
SI	0.04	-0.40	-0.93	-0.81	1	-0.79	-0.95	-0.75	-0.73	-0.99	-1.00	0.96	-0.54
N_2	-0.13	0.37	0.87	0.96	-0.80	1	0.87	0.79	0.77	0.88	0.79	-0.85	0.59
H	0.19	0.73	0.97	0.91	-0.87	0.80	1	0.89	0.79	0.96	0.94	-0.89	0.65
Ma	0.42	0.89	0.83	0.81	-0.66	0.65	0.88	1	0.91	0.78	0.74	-0.66	0.83
Me	-0.44	0.02	0.70	0.69	-0.68	0.73	0.51	0.46	1	0.76	0.74	-0.66	0.86
Mc	-0.07	0.40	0.96	0.88	-0.99	0.88	0.88	0.68	0.72	1	0.98	-0.97	0.57
HE	-0.13	0.23	0.85	0.71	-0.90	0.74	0.67	0.51	0.69	0.89	1	-0.96	0.54
D	0.11	-0.27	-0.78	-0.78	0.94	-0.84	-0.75	-0.53	-0.66	-0.95	-0.92	1	-0.43

Table XXXI. Pearson correlation coefficients relating evenness indices, the number of individuals and the number of species. Correlations below the diagonal were calculated from 135 samples with variable abundances. Correlations above the diagonal were calculated from 60 samples with between 50 and 200 individuals.

	N	S	J	E_{10}	E_{21}	E'_{10}	E'_{21}
N	1	0.51	-0.09	-0.32	-0.11	-0.28	-0.05
S	0.72	1	0.50	0.18	-0.12	0.28	0.06
J	-0.55	-0.34	1	0.89	0.47	0.94	0.65
E_{10}	-0.64	-0.62	0.91	1	0.72	0.99	0.81
E_{21}	-0.41	-0.58	0.66	0.82	1	0.66	0.97
E'_{10}	-0.61	-0.55	0.95	0.99	0.80	1	0.78
E'_{21}	-0.38	-0.46	0.78	0.85	0.97	0.86	1

Table XXXII. Pearson correlation coefficients relating diversity indices and indices in the $E(S_n)$ series. Correlations were calculated from 60 samples with abundances between 50 and 200 individuals.

Index	$E(S_2)$	$E(S_3)$	$E(S_5)$	$E(S_7)$	$E(S_{10})$	$E(S_{15})$	$E(S_{25})$	$E(S_{50})$
N	0.109	0.101	0.082	0.066	0.049	0.031	0.003	-0.026
S	0.675	0.689	0.710	0.726	0.743	0.763	0.786	0.808
H'	0.947	0.960	0.976	0.983	0.986	0.984	0.971	0.933
N_1	0.819	0.845	0.882	0.905	0.925	0.940	0.946	0.926
SI	-0.999	-0.997	-0.985	-0.970	-0.950	-0.921	-0.877	-0.808
N_2	0.790	0.818	0.856	0.878	0.894	0.901	0.892	0.850
H	0.938	0.949	0.959	0.962	0.960	0.951	0.929	0.881
Ma	0.744	0.761	0.789	0.811	0.834	0.862	0.895	0.927
Me	0.741	0.761	0.797	0.825	0.855	0.890	0.933	0.976
Mc	0.984	0.991	0.994	0.989	0.978	0.955	0.916	0.847
Q	0.545	0.561	0.594	0.624	0.661	0.709	0.774	0.843
HE	1.000	0.998	0.987	0.973	0.953	0.925	0.883	0.814
D	-0.955	-0.958	-0.950	-0.936	-0.913	-0.877	-0.821	-0.739

$E(S_2)$ is directly related to SI and consequently, but with differing degrees of linearity, to N_2, HE (Peet, 1974) and Mc (Heip & Engels, 1974). The curvilinear relationship between SI and N_2 (=1/SI) resulted in a greater correlation coefficient between N_2 and $E(S_{15})$ than $E(S_2)$. However, non-parametric correlation coefficients would obviously relate N_2 and $E(S_2)$ at the maximum level. D was also closely associated with the lower end of the $E(S_n)$ series. Ma, Me and Q were much more significantly correlated with $E(S_n)$ indices in the upper end of the series and hence are measures of species richness ($E(S_N)=S$). H' showed an almost 1:1 correspondence with the intermediate index $E(S_{10})$. This relationship, found and discussed previously by Smith et al (1979), was surprisingly independent of the number of individuals within the sample (Table XXXIII).

The evenness indices, particularly J, tended to be positively correlated with S when samples with approximately the same number of individuals were compared. Sheldon (1969) and De Benedictis (1973) showed that this correlation follows directly from the theoretical properties of evenness indices.

Evenness and species richness are generally considered to be end points of a continuum with the different measures of diversity being influenced by these two components in varying proportions (Peet, 1974). This assumption is unjustified as both the $N_2 \rightarrow N_1 \rightarrow N_0$ series of Hill and the $E(S_2) \rightarrow E(S_{10}) \rightarrow E(S_N)$ series indicate that the commonly used diversity indices fall between Simpson's Index, or a directly related function, and species density. Evenness indices are best visualized as functions of the gradients of these diversity series. It should be evident that even though N_2 is often considered to be an evenness term (e.g. Birch, 1981) it differs considerably by being a number

Table XXXIII. Pearson correlation coefficients relating H' and indices in the $E(S_n)$ series. Correlations were calculated from samples with differing abundances.

Abundance Range	n	$E(S_2)$	$E(S_3)$	$E(S_5)$	$E(S_7)$	$E(S_{10})$	$E(S_{15})$	$E(S_{25})$	$E(S_{50})$
10-25	16	0.965	0.978	0.988	0.985	0.972			
26-50	25	0.946	0.973	0.991	0.993	0.991	0.985	0.970	
51-100	36	0.948	0.963	0.981	0.990	0.995	0.993	0.978	0.935
101-200	23	0.953	0.966	0.980	0.987	0.992	0.994	0.991	0.965
201+	31	0.932	0.953	0.978	0.989	0.994	0.994	0.984	0.964

rather than a ratio. For the example of a community composed of two species in equal numbers, N_2 is very low (=2, the number of very abundant species) while all evenness indices are maximal (=1).

The implication of the extremely strong correlation between the evenness indices and animal abundance is that evenness indices should be used with great caution to characterise communities. In samples of a community where all species have not been counted, evenness indices will necessarily decrease with increasing sample size because the denominator of the evenness ratio increases at a faster rate than the numerator as species are added to the collection. This effect is clearly seen in the example given in Table XXXIV and is most characteristic of indices which incorporate S. Although J has been widely employed to describe sampled communities, it generally has been incorrectly used because the total number of species has not been known (Pielou, 1975). Evenness indices based on the ratio of N_2 to N_1 are more robust because they become relatively independent of sample size whenever animal abundances exceed a threshhold level. Despite the theoretically unbounded nature of H', Margalef (1972) has shown that this index is bounded in practical situations (see also May, 1975), and Sanders (1968) found that it remained constant with sample sizes greater than 200 individuals. The correlation coefficients of Table XXXII also indicated that H' became relatively stable for sample sizes greater than 50 in this study. Thus, changes in sample sizes above 200 individuals will probably not greatly affect H', N_1(=exp(H')) or N_2 (which varies only in a relatively minor way with animal abundance), and the index N_2/N_1 can be reliably used. Alatalo's (1981) correction should be used in these situations, however, to prevent the anomaly of N_2/N_1 going to 1 in situations of extreme dominance (as N_2 and N_1 both go to 1).

Table XXXIV. Diversity and evenness indices calculated for an assemblage of phytal animals collected from Acrocarpia paniculata and several derived subsamples. The distribution of abundances of the species in collection 1 (with frequencies in parentheses) was 928, 784, 765, 234, 194, 149, 57, 52, 43, 24, 22, 20, 18, 17, 16, 15, 13, 11, 9, 8(2), 7, 5(2), 4(4), 3(3), 2(9), 1(19). Collection 2 represented the expected abundances of species in a subsample of 10% of collection 1 (a species-abundance distribution of 93, 78, 77, 23, 19, 15, 6, 5, 4, 2(7), 1(8)). Collection 3 represented a 99% reduction of collection 1 (a species-abundance distribution of 9, 8(2), 2(2), 1(3)). Collection 4 was similar to collection 3 but expanded 100 times (a species-abundance distribution of 900, 800(2), 200(2), 100(3)).

Index	Collection			
	1	2	3	4
N	3466	342	32	3200
S	59	24	8	8
H'	2.13	2.04	1.72	1.72
SI	0.182	0.187	0.215	0.215
N_1	8.43	7.67	5.59	5.59
N_2	5.49	5.35	4.65	4.65
J	0.52	0.64	0.83	0.83
E_{10}	0.143	0.32	0.70	0.70
E'_{10}	0.128	0.29	0.66	0.66
E_{21}	0.65	0.70	0.83	0.83
E'_{21}	0.60	0.65	0.80	0.80

For each of the phytal samples discussed in the following sections, the number of individuals (N), the number of species (S) and the inverse of Simpson's Index (N_2) have been used to describe the samples because they encompass the range of diversity indices. S was chosen in preference to the other three species richness indices because the relationships between S and ln N and $\sqrt{N}$ were not linear, and Q becomes unreliable with low species number (Kempton & Wedderburn, 1978). If all samples in this study had been rich in species Q could have been usefully used to reduce the variability caused by differing sample size. All dominance related indices (SI, N_2, HE, $E(S_2)$, Mc, D) could equally well have been used as parameters of phytal samples. N_2 was chosen because it is expressed in the same units as S and hence is directly comparable. Moreover, the other dominance-related indices are bounded on both sides (by 0, 1 or 2) and as they approach the asymptote show relatively minor changes with marked changes in the species-abundance distribution. The inverse of dominance, which is measured by N_2, will be referred to as heterogeneity (see Peet, 1974).

Alatalo's correction of Hill's Ratio (E'_{21}) has also been calculated for each sample so that comparison can be made with evenness indices published in related studies. However, significant correlations between this index and physical variables generally have not been discussed because they were directly attributable to changes in the other community parameters.

5.3.2 Habitat Complexity

The mean values and the standard deviations of the diversity parameters for each algal species collected at the semi-exposed Fancy Point site are listed in Table XXXV. There is little evidence to support Hicks' (1980) contention that algae with relatively large surface areas (such as Cladophora feredayi, Halopteris pseudospicata, Anotrichium sp. and Ulva sp.) possess greater habitat complexity than other algal species, and consequently greater diversity of animals. In fact, the opposite relationship seems to occur with the highly dissected algae having both lower species density and lower animal heterogeneity. The comparatively low diversity of animals among the fine-bladed algae was confirmed by the correlation coefficients relating the measured physical components of algal structure and N_2 (Table XXXVI). Non-parametric Spearman rank correlations rather than Pearson correlations were calculated between the physical variables and the community parameters because many of these relationships were not linear. The highly significant correlation between the log final width of branches (LFW) and N_2 was presumably a direct consequence of the size relationships described in the earlier chapter on spatial patterns. Filamentous algae have a preponderance of small animals with large population sizes, resulting in the considerable numerical dominance of a few species (Fig. 22). The degree of branching (DB) and N_2 were also significantly correlated, largely because of the high intercorrelation between DB and LFW ($r=-0.502$). As well as the filamentous algal species, the wide-bladed algae Ulva sp. and Carpoglossum confluens were also characterised by very low animal heterogeneity. Carpoglossum possessed a

Table XXXV. Mean values (± standard deviations) of the community parameters for the algal species collected at Fancy Point.

Algal Species	N	S	N_2	E'_{21}
Thamnoclonium clariferum	99.4±28.6	25.4±7.9	10.6±3.4	0.66±0.13
Anotrichium sp.	28.2±19.3	8.4±3.0	3.8±1.2	0.67±0.08
Hemineura frondosa	67.4±32.8	20.2±3.3	9.9±1.5	0.72±0.07
Plocamium angustum	94.6±45.0	22.6±7.7	5.8±0.6	0.54±0.11
Phacellocarpus labillardieri	79±110	25.8±10.5	7.1±2.8	0.59±0.15
Jeannerettia lobata	109±59.6	26.2±5.7	10.1±2.9	0.64±0.08
Hormosira banksii	49.8±34.8	10.2±4.7	5.8±3.3	0.75±0.07
Halopteris pseudospicata	740±517	25.6±6.8	3.9±1.2	0.59±0.08
Ecklonia radiata	16.0±14.7	9.0±5.0	6.2±2.6	0.86±0.14
Ecklonia radiata	114±87.6	24.2±8.6	8.7±3.6	0.62±0.15
Acrocarpia paniculata	2032±1336	52.2±11.3	5.6±1.0	0.51±0.08
Cystophora torulosa	550±475	34.6±10.0	7.8±4.5	0.59±0.12
Cystophora retroflexa	321±528	22.8±10.6	8.7±3.5	0.68±0.12
Cystophora moniliformis	657±596	30.6±8.9	6.3±2.4	0.52±0.10

Table XXXV (Cont.).

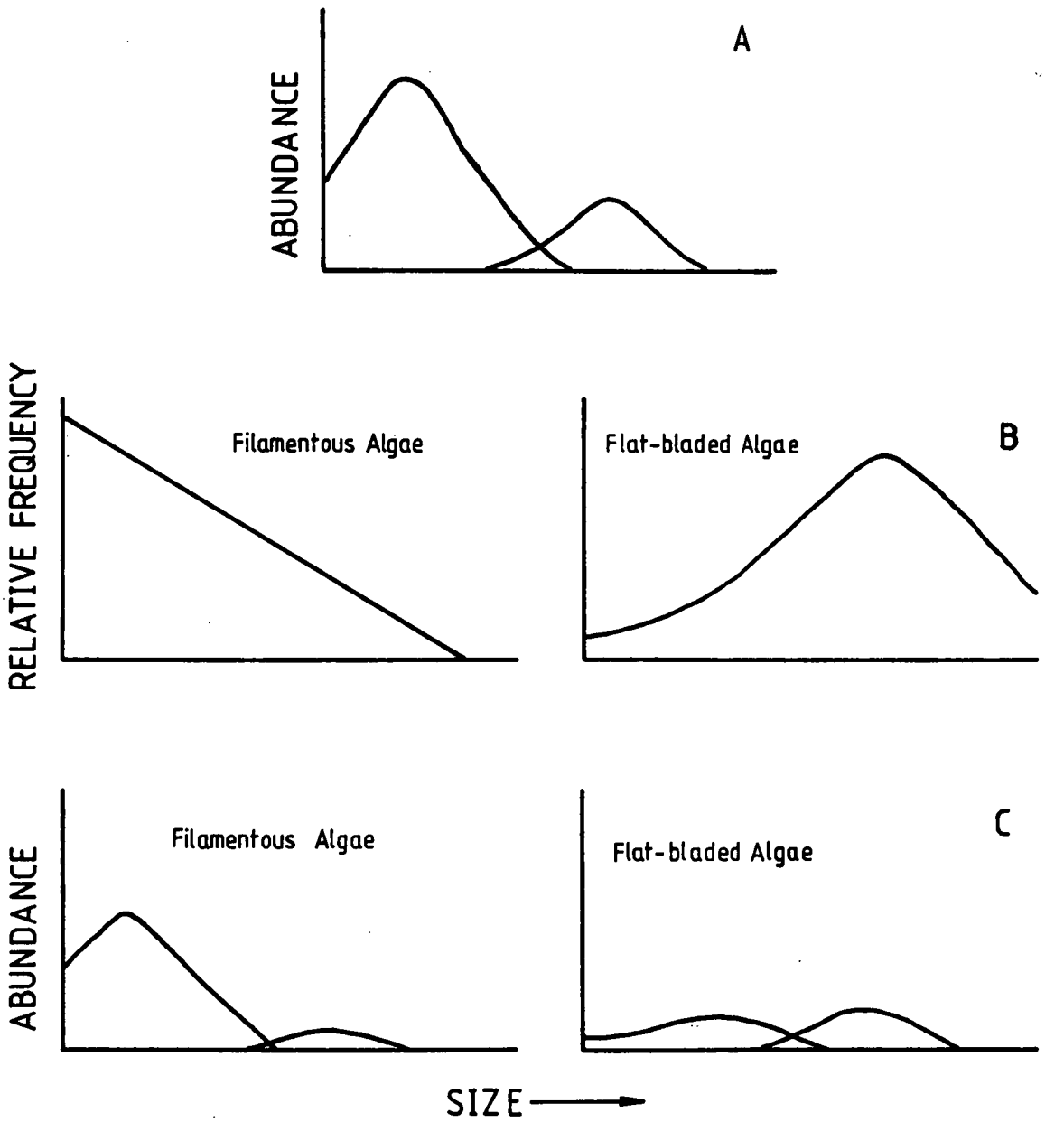
Algal Species	N	S	N_2	E'_{21}
Caulocystis cephalornithos	409±320	25.4±5.1	8.2±2.4	0.70±0.06
Sargassum decipiens	607±536	31.2±13.5	8.7±2.2	0.63±0.12
Sargassum bracteolosum	210±97.6	33.2±8.0	13.2±3.9	0.68±0.08
Sargassum verruculosum	60.0±65.9	13.2±6.6	6.2±3.6	0.69±0.12
Carpoglossum confluens	8.2±4.2	3.4±2.5	0.69±0.23	
Seirococcus axillaris	632±470	38.0±9.9	9.7±6.8	0.56±0.20
Zonaria turneriana	47.8±19.3	20.4±8.9	12.3±6.3	0.76±0.09
Zonaria sp.	73.6±32.5	18.8±5.8	7.4±4.1	0.59±0.13
Caulerpa trifaria	36.6±22.2	17.2±7.2	10.3±4.1	0.78±0.13
Caulerpa geminata	63.8±18.6	24.6±7.0	13.5±6.0	0.72±0.11
Ulva sp.	21.8±16.8	4.8±2.3	2.4±1.1	0.72±0.24
Cladophora feredayi	72.2±34.1	11.4±2.2	4.7±1.3	0.70±0.11

Table XXXVI. Spearman rank correlation coefficients relating community parameters and the physical variables discussed in detail in Chapter 2. DE, depth; WW, wet weight; DW, dry weight; EW, epiphytic weight; SA, surface area; ML, maximum length; LMW, log maximum width of primary axis; DB, degree of branching; LFD, log depth of final branches; LFW, log width of final branches.

Variable	N	S	N_2	E'_{21}
DE	-0.362***	-0.165	0.345***	0.284**
WW	0.589***	0.568***	-0.004	-0.196*
DW	0.462***	0.469***	0.006	-0.190*
EW	0.462***	0.423***	0.104	-0.038
SA	0.471***	0.265**	-0.281**	-0.244**
ML	0.405***	0.266**	0.148	-0.118
LMW	0.201*	0.269**	0.123	-0.062
DB	0.132	-0.075	-0.356***	-0.282**
LFD	0.112	0.235*	0.195*	0.118
LFW	-0.164	0.114	0.390***	0.192*

* 0.05>P>0.01, ** 0.01>P>0.001, *** P<0.001.

Fig. 22. Hypothetical example showing the greater expected heterogeneity of animals on wide-bladed algae (such as Zonaria) compared to finely-branched algae (such as Halopteris). A. The total size-abundance distribution of two amphipod species among all algae within the study area. Note that small species are generally more abundant than larger species. B. The relative proportions of the total animals of different sizes which are found on finely-branched and wide-bladed algae (c.f. the size distributions of animals associated with Halopteris and Zonaria in Fig. 5). C. The expected size distributions of the two amphipod species on finely-branched and wide-bladed algae.

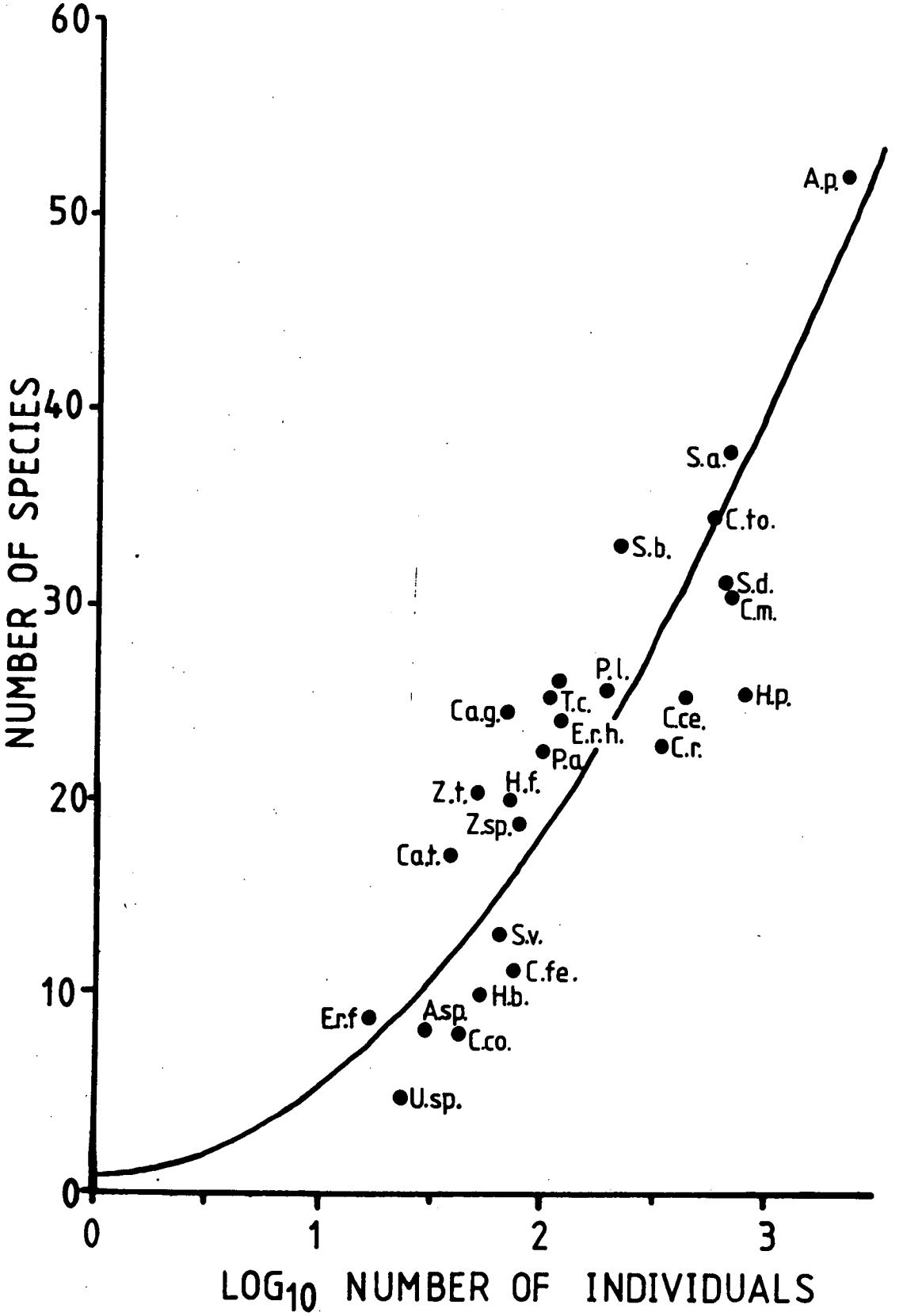

A
ABUNDANCE
RELATIVE FREQUENCY
Filamentous Algae
Flat-bladed Algae
B
ABUNDANCE
Filamentous Algae
Flat-bladed Algae
C
SIZE

slimy coating of chemical exudates and it is possible that few animal species survive for long periods on both this species and Ulva because of toxins such as those reported by Magre (1974).

The great variability in the weights and surface areas of the different algal species makes comparison of species density between plants difficult. Nevertheless, the species density/log abundance curve shown in Fig. 23 indicates that the algae with the relatively greater number of species (high species richness) were those such as Sargassum bracteolosum, Seirococcus axillaris, Caulerpa geminata and Jeannerettia lobata with considerable variation in the widths of axes and branches. Algae growing close to the reef substratum such as Caulerpa spp., Zonaria spp., Ecklonia radiata holdfasts and Cystophora torulosa were also rich in species, primarily because they have a component of benthic as well as phytal animals. One further alga with high species richness, Thamnoclonium clariferum, was heavily colonized by epiphytic sponges and bryozoans and had a number of animal species associated with this sessile fauna (e.g. the amphipods Leucothoe spp., Colomastix sp. and Seba sp.). The correlation coefficients shown in Table XXXVI indicate that the species density and the number of individuals increased with the weight of algae and epiphytes at approximately the same level of significance. Surface area was much more highly correlated with N than with S. The large number of animal species associated with algae having both wide and thin axes probably caused the significant correlation between the log maximum width of primary axis (LMW) and S.

Perhaps the reason for the disagreement between the findings of this study and those of Hicks (1980) relates to the size of the organisms under investigation. Macrofauna possibly treat filamentous algae as a single habitat, but partition the wider algae into several habitats of differing

Fig. 23. Relationship between the number of species and the logarithm of the number of individuals for animals collected from different algae. The curve of best fit $Y = 1+4.55X^{1.974}$ has been plotted. Algal abbreviations are as follows: T.c. Thamnoclonium clariferum, A.sp. Anotrichium sp., H.f. Hemineura frondosa, P.a. Plocamium angustum, P.l. Phacellocarpus labillardieri, J.l. Jeanneretia lobata, H.b. Hormosira banksii, H.p. Halopteris pseudospicata, E.r.f. Ecklonia radiata fronds, E.r.h. Ecklonia radiata holdfasts, A.p. Acrocarpia paniculata, C.to. Cystophora torulosa, C.r. Cystophora retroflexa, C.m. Cystophora moniliformis, C.ce. Caulocystis cephalornithos, S.d. Sargassum decipiens, S.b. Sargassum bracteolosum, S.v. Sargassum verruculosum, C.co. Carpoglossum confluens, S.a. Seirococcus axillaris, Z.t. Zonaria turneriana, Z.sp. Zonaria sp., Ca.t. Caulerpa trifaria, Ca.g. Caulerpa geminata, U. sp. Ulva sp., C.fe. Cladophora feredayi.


NUMBER OF SPECIES
60
50
40
30
20
10
0
0
1
2
3
LOG10 NUMBER OF INDIVIDUALS
A.p.
S.a.
C.to.
S.b.
S.d.
C.m.
P.l.
T.c.
H.p.
Ca.g.
C.ce.
E.r.h.
C.r.
P.a.
Z.t.
H.f.
Z.sp.
Ca.t.
S.v.
C.fe.
H.b.
Er.f
A.sp.
C.co.
U.sp.

branch widths, while meiofaunal harpacticoid copepods respond to the surface area of wide algae as a unit but subdivide the filamentous environment. In a related study on habitat complexity, Luckhurst & Luckhurst (1978) found that the number of large fish species was significantly correlated with the rugosity of coral reefs, but no significant relationship was found for the smaller species.

5.3.3 Depth

The heterogeneity of the phytal assemblage increased significantly with depth but the number of individuals and the number of species decreased, the latter however at an insignificant level (Table XXXVI). In order to reduce the variability resulting from differences in size and shape of algae, the correlation coefficients were recalculated using data from the elongate fucoid algae belonging to the genera Cystophora, Acrocarpia, Caulocystis and Sargassum which had wet weights between 25 and 200 grams. Animal abundance ($r=-0.674$, $n=28$, $p<0.001$) and species density ($r=-0.517$, $p=0.002$) were again negatively correlated with depth, while N_2 ($r=0.446$, $p=0.009$) and evenness ($r=0.614$, $p<0.001$) were positively correlated with depth.

The scatter diagram relating S to depth (Fig. 24) shows that the relationship between these variables was non-linear, with a pronounced increase in the species density occurring in waters shallower than 2 metres. This depth was similar to that at which considerable changes in both the algal and faunal assemblages occurred.

The decrease in the dominance of the phytal assemblage with depth was caused by several very abundant amphipods which were present only in shallow water and were probably responding to the increased food resources in regions

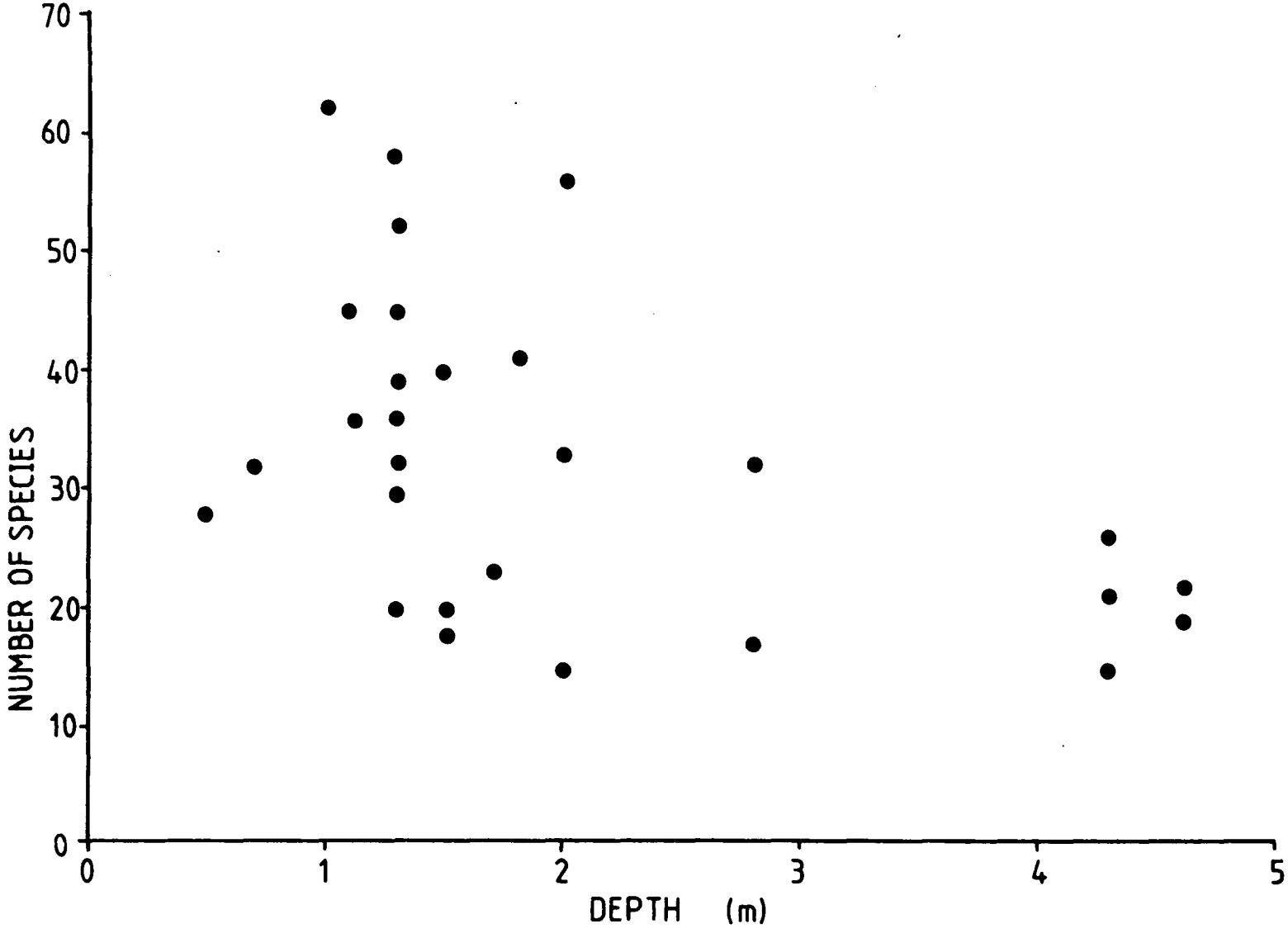


Fig. 24. Scatter diagram showing the number of species versus depth for animals associated with elongate fucoid algae.

of considerable water flow. When the species-abundance distributions of animals among the five Sargassum verruculosum and Caulocystis cephalornithos collected in shallow water are compared with the faunas on five similar plants from deeper water (Fig. 25) it is clearly evident that very abundant phytal species were absent from deep water. Caulocystis and S. verruculosum were grouped together in this analysis because the faunas on these species were previously found to be indistinguishable and the mean dry weight of these algae collected in deep water (4.20g) was similar to that of plants from shallow water (4.46g). The abundance histograms of the faunas associated with these algae also indicate that the 'shallow' algae had a greater component of rare animals (those occurring on a single occasion) than the 'deeper' plants. This may be related to the species richness of the algal assemblage which was greatest at 1.0 metres depth and possibly allowed a comparatively large species pool of phytal animals to coexist.

5.3.4 Season

Despite the peaks of abundance shown by most animal species occurring in late summer/early autumn at the sheltered Fancy Point site, the heterogeneities of the phytal assemblages on all erect algae were low at this time (Fig. 26) because the plants were dominated by a few rapidly growing amphipod species capable of responding quickly to the considerable epiphytic resources. The heterogeneity of animals was greater on Zonaria than on the erect algae over the summer months, possibly due to the large proportion of benthic species in the Zonaria assemblage partly buffering the dramatic increases in the abundant phytal species.

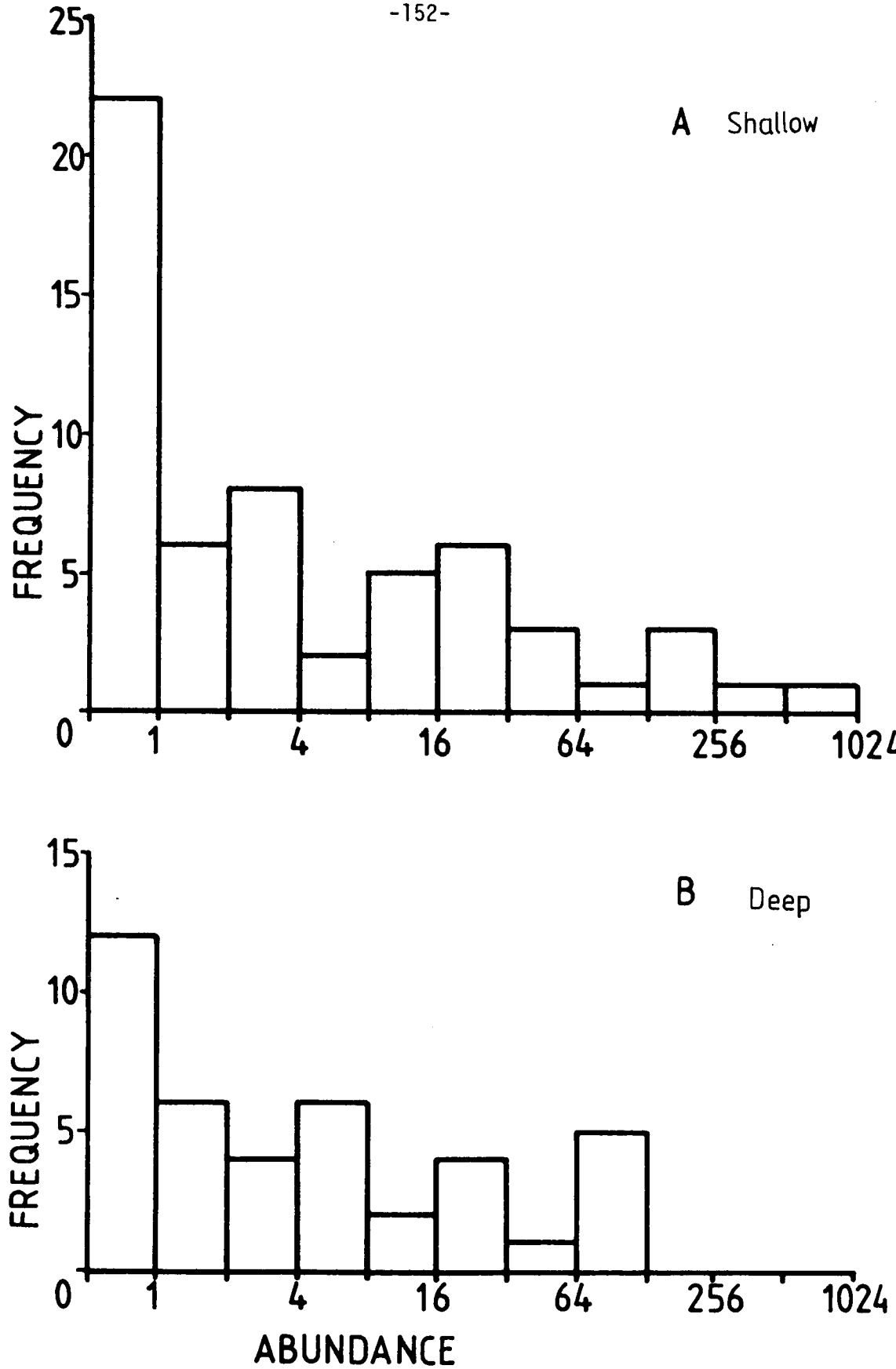


Fig. 25. Species-abundance distributions of the faunas collected from Sargassum verruculosum and Caulocystis cephalornithos from deep (>2.3m) and shallow (<2.2m) water depths.

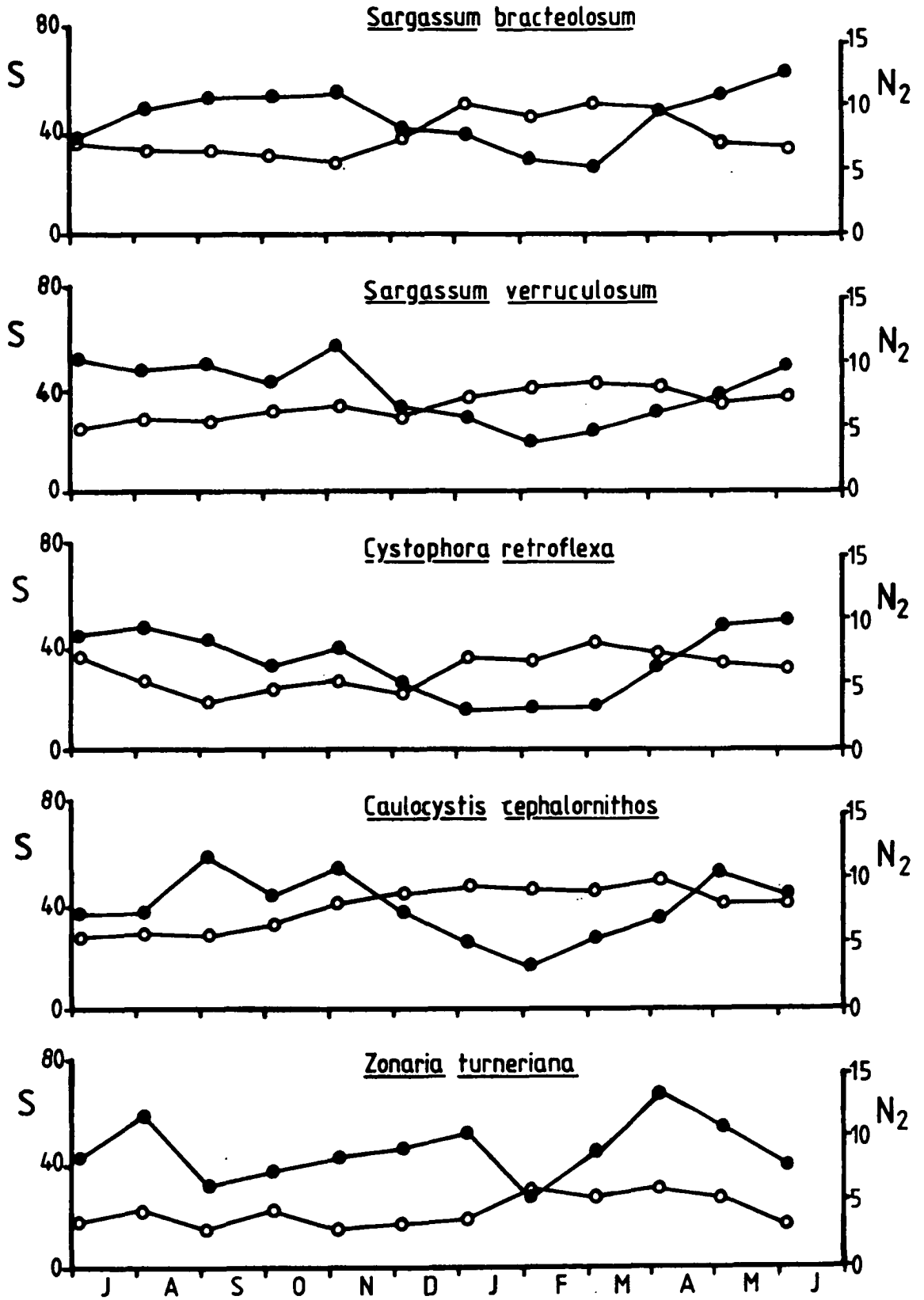


Fig. 26. Seasonal variation in the number of species (open circles) and N_2 (closed circles) for phytal assemblages collected from different algae.

Seasonal changes in S were opposite to changes in N_2 with the greatest number of phytal species per plant occurring in March and April. This was caused by the collection of rare species on plants most frequently during autumn, the time when those species became most abundant, rather than the migration of additional species from other habitats. The total number of species collected from July to December (191 species) was almost identical to the number collected over the first six months of the year when individual plants had their greatest species densities (187 species).

Thus, seasonal changes in the heterogeneity and the number of phytal species per plant were almost certainly related to the level of epiphytes. Whether the primary response of phytal animals to epiphytes was due to the increased food resources or to the habitat complexity of filamentous algae remains to be determined, but it is likely that these factors were interrelated and both contributed to the species diversity patterns.

5.3.5 Exposure

The responses of the community parameters to exposure were assessed by comparing the algal assemblages at the sheltered and semi-exposed Bruny Island sites and the samples of Zonaria and Cystophora moniliformis collected from the exposed coast of Bruny Island at One Tree Point. The influence of exposure on the diversity indices was found to depend greatly on algal shape (Table XXXVII).

At the exposed site, the animal assemblage associated with elongate Cystophora moniliformis was characterised by very low species richness and the extreme abundance and dominance of two filter feeding amphipod species. Podocerus sp. comprised 95% of all animals at 1 metres depth while 84% of the

Table XXXVII. Mean values (± standard deviations) of the dry weights of algae collected at sites with different wave exposure and the community parameters associated with those algae. Five replicates were collected in all cases other than at the sheltered site where data for fifteen algae collected in September, October and November have been grouped. S' indicates the total number of species collected in five samples.

Algal Species	Exposure*	Depth (m)	Dry Weight(g)	N	S'	S	N_2	E'_{21}
Elongate Algae								
Cystophora moniliformis	E	1	4.9±6.6	1250±1920	23	9.4±2.7	1.4±3.9	0.35±0.21
Cystophora moniliformis	E	6	9.3±9.2	784±462	34	14.4±5.6	2.6±2.9	0.53±0.12
Cystophora moniliformis	M	1	14.2±11.7	657±596	56	30.6±8.9	6.3±2.4	0.52±0.10
Sargassum decipiens	M	1	4.4±3.9	607±536	61	31.2±13.5	8.7±2.2	0.63±0.12
Sargassum verruculosum and Caulocystis cephalornithos	M	1	4.5±2.8	344±377	58	21.4±9.0	6.8±3.4	0.65±0.09
Sargassum verruculosum and Caulocystis cephalornithos	M	4	4.2±3.2	125±103	40	17.2±8.4	7.7±3.0	0.73±0.06
Sargassum verruculosum	S	3	8.2±3.6	374±147	53±12	30.9±6.0	9.7±2.4	0.68±0.10
Caulocystis cephalornithos	S	3	14.7±9.1	426±287	61±17	33.2±8.0	10.5±2.4	0.64±0.07
Short Algae								
Zonaria sp.	E	6	2.1±1.2	235±227	91	37.0±16.6	13.9±12.3	0.59±0.20
Zonaria sp.	M	2	3.8±2.0	73.6±32.5	56	18.8±5.8	7.4±4.1	0.59±0.13
Zonaria turneriana	M	2	2.1±1.4	47.8±19.3	69	20.4±8.9	12.3±6.3	0.76±0.09
Zonaria turneriana	S	3	1.2±1.0	98.5±117	40±10	17.3±6.4	7.2±2.2	0.71±0.12

* E: fully-exposed, M: semi-exposed, S: sheltered

total abundance at 6 metres depth was contributed by Caprella sp. Animal abundance did not vary greatly with exposure at the sheltered and semi-exposed sites but remained considerably less than at the fully exposed site. Species density also remained approximately constant at the Fancy Point sites while animal heterogeneity increased with the degree of shelter.

The species density and heterogeneity of the faunal assemblages associated with Zonaria showed the opposite relationships to those deduced for the elongate algae. S and N_2 both increased with the degree of wave exposure.

Few animal species probably survive the whiplash motion of Cystophora at the exposed site while Zonaria clumps buffer the effects of wave action and act as refuges. This is indicated by the greater species density of animals on Cystophora at 6 metres depth, where wave action would have been considerably diminished, than at 1 metre. Moreover, the two amphipod species which occurred abundantly on Cystophora were adapted to the motion of the environment by possessing strong, hook-like pereiopods.

The greater numbers of animal species on Zonaria at One Tree Point compared to the more sheltered, and hence stable, Fancy Point sites indicates that the number of species gradually increases with exposure but sharply declines in conditions of extreme wave action (such as encountered by the Cystophora assemblage). A very similar relationship was found previously in New Zealand by Fenwick (1976). A reduction in species density in sheltered environments could account for the relatively low species density which was observed at the greatest depths at Fancy Point.

5.3.6 Latitude

The effect of latitude on the species density (Fig. 27) and heterogeneity (Fig. 28) of phytal assemblages was minor in comparison to the previously discussed variation at Bruny Island. Hence water temperature, a factor considered important by Rohde (1978), does not appear to influence diversity parameters greatly.

The species density of animals on both Sargassum and Zonaria-like plants showed a slight decrease from Tasmania to Mackay, Queensland and then increased towards north Queensland. This relationship was possibly a consequence of the decline in abundance and species density of macro-algae (and hence habitat complexity on a gamma scale) towards central Queensland and then the increased structural complexity introduced by calcareous reefs in the lower latitudes. The Magnetic Island, Russel Island and Wentworth Reef samples were all collected from plants in the vicinity of coral reefs. These samples had considerable proportional abundances of molluscs, polychaetes and ophiuroids (Appendix 4), many of which were presumably coral reef associated animals. Data collected at the most northerly sampling site at Lizard Island (7 algal species, each with 10 replicates), which remains largely unanalysed, also indicated the coralliferous origin of faunas associated with reef algae. One algal species (Halimeda cylindracea (L.) Lamouroux) grew as isolated plants from a sandy substratum (only a few metres from reefs), while all the other sampled algae were attached to coral reefs. A remarkably homogeneous phytal assemblage, which was dominated by amphipods (including ampithoids), was associated with Halimeda cylindracea, while the faunistic similarities

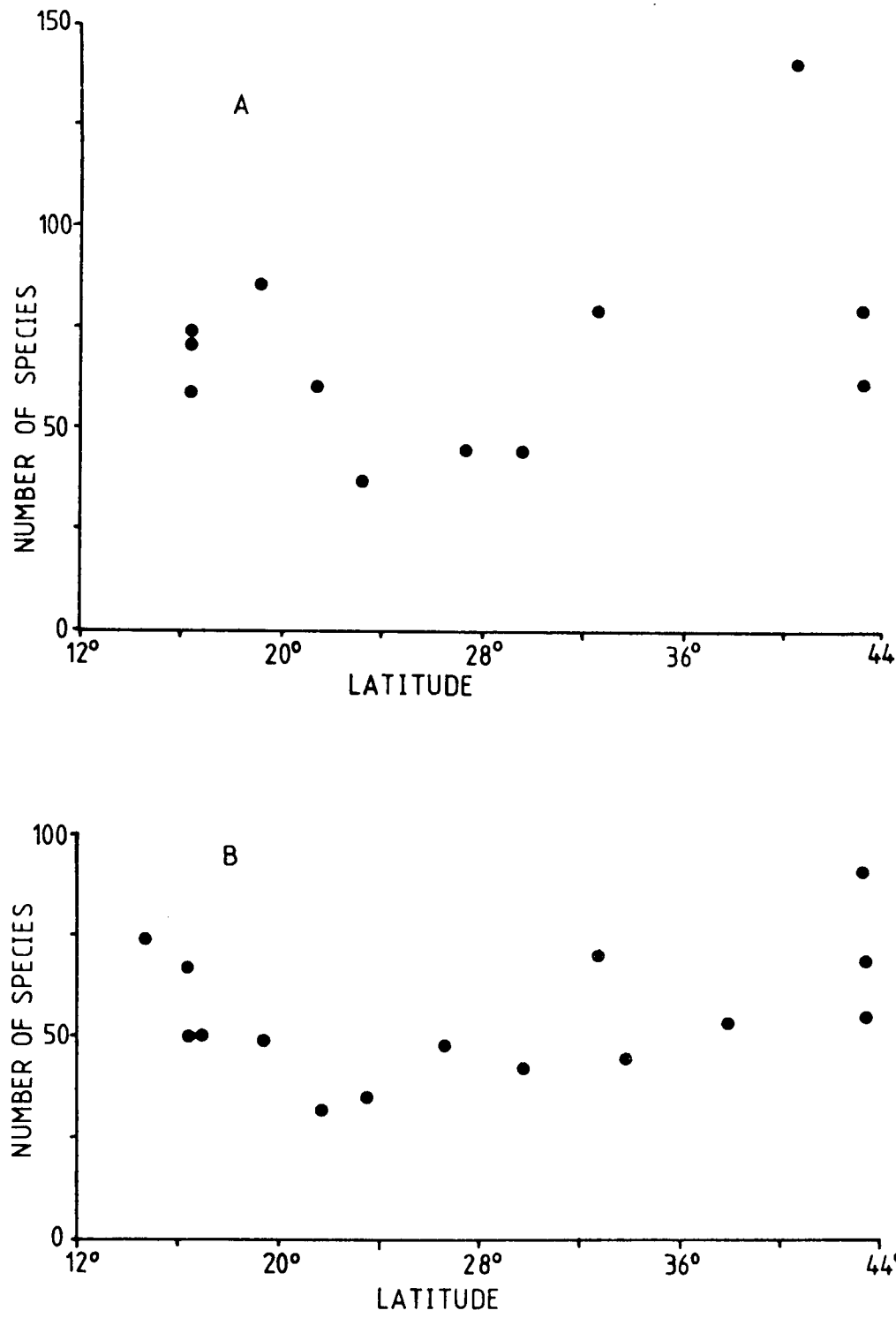


Fig. 27. The relationship between latitude and the number of phytal species which were collected in five samples of Sargassum (A) and Zonaria-like (B) plants.

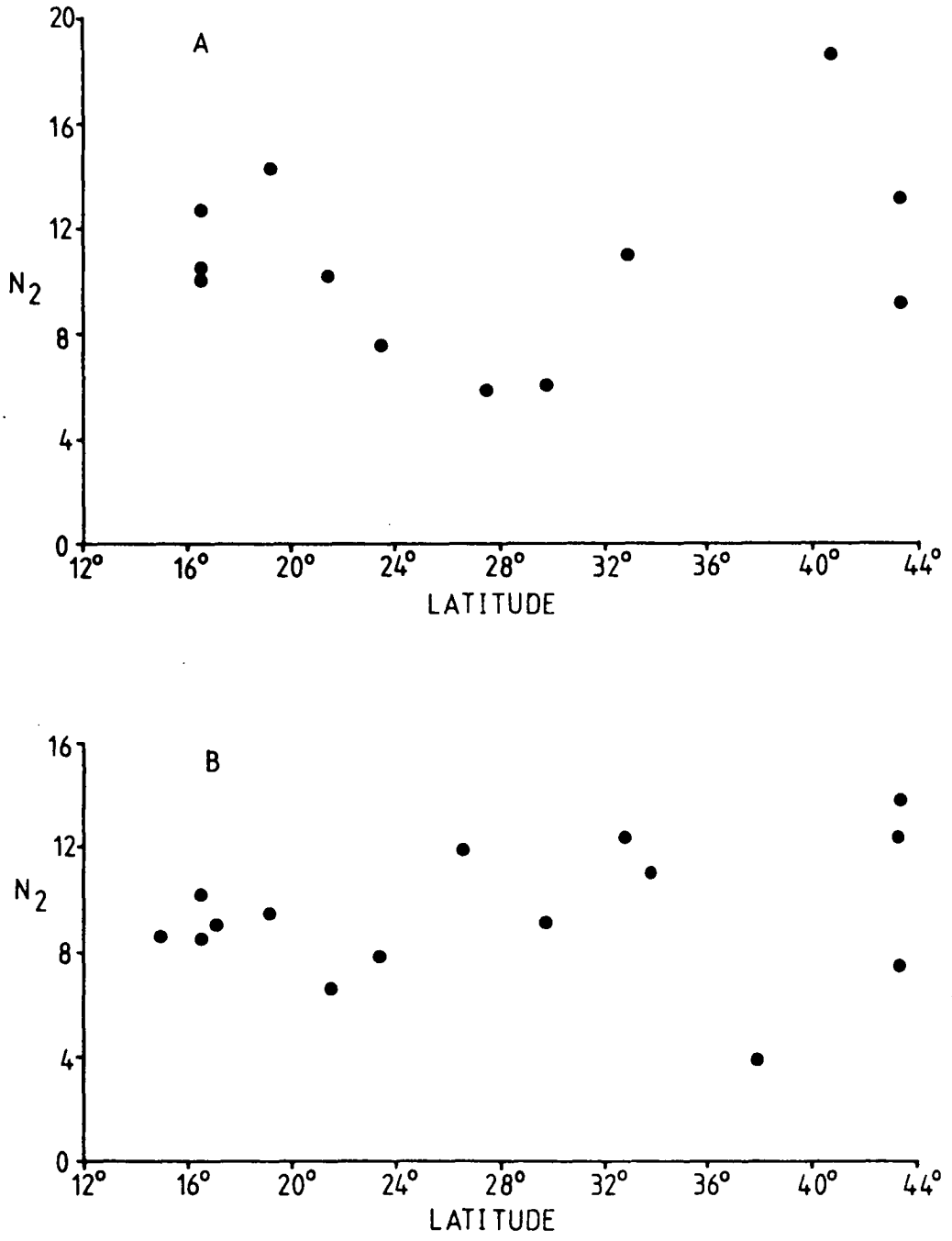


Fig. 28. Scatter diagram showing the relationship between latitude and the mean heterogeneity (N_2) of phytal samples collected from Sargassum (A) and Zonaria-like (B) plants.

between the other sampled plants were extremely low. It thus appears that the isolation of Halimeda from reefs allows a true phytal assemblage to develop, but that much of the reef cryptofauna does not discriminate between coral and macro-algal habitats.

5.4 GENERAL DISCUSSION AND CONCLUSIONS

5.4.1 Comparison of Marine and Terrestrial Communities

A distinctive characteristic of phytal assemblages is the wide distributions among plants of almost all of the animal species. Although many animals associated with terrestrial plants are also generalists, specialists restricted to one or a few plant species comprise a sizeable proportion of communities (Eastop, 1972; Futuyma & Gould, 1979). The major reason for this contrast in community structure is probably the almost exclusive reliance of phytal animals on food resources external to the plant substratum (such as detritus, epiphytic algae and particles in the water column). Animals residing on terrestrial plants, other than carnivores, generally feed directly on plant tissues or sap, and those animal species which specialize probably do so in order to breach particular chemical defenses (Janzen, 1973b). It is notable that the one abundant alga-boring animal at Fancy Point (the amphipod Bircenna sp.) was only collected from algae belonging to the order Fucales.

The sampling techniques used to collect fauna associated with terrestrial plants are varied but differ considerably from the methods used in this investigation. Consequently, published data which are directly comparable to the results of this study are not available. Nevertheless, a subjective comparison of related terrestrial data (e.g. the samples of Menhinick, 1967; Janzen, 1973a, 1973b; Root, 1973) indicates that marine systems probably have

greater alpha species density but much lower gamma species density. This is to be expected because of both the greater environmental stability of marine compared with terrestrial environments, and the increased animal densities resulting from the abundant external food resources. On the other hand, gamma species density is likely to be far greater in terrestrial systems because environmental gradients (temperature, humidity, rainfall etc.) have considerable local ranges of variation and consequently can be partitioned into a relatively large number of distinct macro- and micro-habitats. The species richness of the plants themselves, correlated with insect diversity by Murdoch et al (1972), also contributes to the gamma diversity of plant-associated animals and is several orders of magnitude higher on the land than in the sea.

Birch (1981) recently suggested that terrestrial and marine systems may be organised in different ways because species richness and evenness tended to be negatively correlated in marine communities but were presumed to be positively correlated in terrestrial communities. He found no similar correlation between S and SI. While these findings could be explained in terms of the differences in alpha and gamma diversity discussed above, a re-evaluation of the data used by Birch indicated that the significant correlation almost certainly resulted from nothing more than the mathematical property that evenness is negatively correlated with animal abundance. The two cited papers with data showing significant correlations between S and (1-J) (Gauld & Buchanan, 1956; McCloskey, 1970) also showed equally significant correlations between N and both S and (1-J).

5.4.2 Diversity Indices

Animal abundance (N), species density (S) and heterogeneity (N_2) have each provided useful information on the structure of phytal assemblages in this study. Animal abundance (density per plant) and N_2 were closely related to each other as they appeared to be dependent on the level of food resources within the environment. Species density and N_2 proved to be relatively independent and presumably responded to different environmental conditions. S and N_2 were positively correlated to each other in the studies of the exposure gradient and algal structure, but were negatively correlated in the studies of depth and seasonality.

Evenness indices did not contribute to the understanding of Bruny Island phytal assemblages. There is little doubt that evenness indices can efficiently discriminate between samples with different species-abundance distributions. Interpretation of these differences, however, is difficult because of the varied influences of animal abundances, species density and dominance on evenness. The correlation found in this study between depth and E_2' ($r=0.614$, $n=28$, $p<0.001$) was much more significant than those between depth and either S or N_2. Nevertheless, this predictable change in evenness could only be understood by reference to other indices and resulted from the synergistic effects of decreased animal abundance and increased heterogeneity with depth. Similar criticisms of evenness were originally made by Peet (1975) but have since attracted little attention.

Rarefaction curves were not investigated in this study due to the anticipated lack of additional information which they would provide. These curves are also sometimes difficult to interpret because they are greatly influenced by the number of individuals per sample. Species richness, as deduced from rarefaction curves, would have been found to increase with depth

at Fancy Point because of the great abundance of filter-feeding caprellid and podocerid amphipods in shallow water. However, species density was found to decrease significantly.

5.4.3 Factors Influencing Diversity

The three environmental factors which have been proposed previously to contribute to diversity were each found to influence the diversity indices, but in different ways:

1. Habitat Complexity. Simple, flat-thalloid algae and finely filamentous plants (both forms with great regularity in branch shape) were found to have very low species richness and heterogeneity. Both S and N_2 were positively related to the "diversity" (sensu heterogeneity) of physical structures such as branch widths within the plant but not to the surface area/weight ratio (the degree of dissection). The well known relationship between diversity and structural complexity thus does not appear to be a simple function of rugosity but is probably dependent on an increase in the number of habitats as complexity increases and/or increasing animal abundance with increasing surface area. The size of structures within the habitat also seems to be of considerable importance, possibly because additional species may be able to survive within an environment if sufficient refuges within a given size range are available from predators.

An indication of the relationship between size, habitat complexity and diversity can be seen by comparing the gamma species density of fish in New Guinea (as described by Munro, 1958) with Tasmania (as deduced from an unpublished checklist of fish compiled by P.R. Last). Although New Guinea differs from Tasmania by comprising a larger area and having a less well known

icthyofauna, dispersal of species along the east Australian coastline between these regions is possible and general diversity trends can be ascertained. New Guinea and Tasmania have similar numbers of fish families (155 cf. 127) but vastly different numbers of species (1429 cf. 538). A comparison of the abundant fish families within these two regions (Table XXXVIII) indicates that the speciose families in New Guinea primarily are those associated with coral reefs (e.g. Labridae, Pomacentridae, Gobiidae, Chaetodontidae, Apogonidae, Epinephilidae (now subsumed in Serranidae), Lutjanidae, Scaridae) while Tasmania has relatively few families with many species and most of these are associated with algal and seagrass habitats (Syngnathidae, Clinidae, Gobiidae). Thus it appears that the diversity of tropical fish faunas is largely a consequence of the structural complexity of coral reefs while temperate marine habitats, which lack hermatypic corals, have numbers of species associated with the considerable abundance and diversity of macro-algae. The range in size of fish follows from these habitat types; coral reef fish showing a broader size spectrum (related to the wide range of coral reef habitat sizes, see Dahl, 1973) than the small pipefish, clinids and gobies which live amongst algae.

2. Environmental Stability. A bell-shaped relationship similar to that predicted by Huston (1979), was deduced between environmental stability (as measured by wave exposure) and both species richness and heterogeneity. The reduced values of the diversity indices in conditions of extreme exposure almost certainly occurred because few phytal species were capable of surviving the disturbances which elongate algae underwent at the wave-swept site. The reasons for the reduced species richness in the calm habitats are more complex and possibly resulted from the aversion of many phytal species to the high detritus levels which were present on sheltered macro-algae (Dahl, 1948) and

Table XXXVIII. Abundant fish families in New Guinea and Tasmania.

New Guinea		Tasmania	
Family	Species No.	Family	Species No.
Labridae	78	Myctophidae	29
Pomacentridae	57	Syngnathidae	24
Gobiidae	51	Clinidae	17
Chaetodontidae	50	Gobiidae	17
Carangidae	46	Galaxidae	15
Apogonidae	41	Monacanthidae	13
Eleotridae	41		
Epinephelidae	37		
Lutjanidae	37		
Scaridae	35		

also the slightly greater seasonal variation in water temperatures. Alternatively, particular phytal species may have outcompeted others within the stable environment and excluded the poor competitors from plants. Such effects are well documented to occur on an ecological time scale in the rocky intertidal (Connell, 1961; Dayton, 1971) and are still consistent with the high diversity hypothesized to occur in stable environments such as the deep sea during an evolutionary time period. Species capable of controlling the abundances of the dominant competitor within a stable environment could presumably enter the system over a lengthy period of time, enriching the community and allowing a different species to become abundant until it is itself controlled.

3. Food Resources. Both the biomass of filamentous epiphytes and water depth (which was considered to be directly related to water movement and the flux of suspended food particles) were found to be strongly correlated with the abundance and dominance of the phytal assemblage. An increase in the abundance of rare species during the autumn period of maximum epiphytic biomass also resulted in an increase in the alpha species density. However, this effect, compounded by a concurrent increase in structural complexity, became difficult to detect with large sample size and would not occur on a gamma diversity scale. The contradictory results of previous productivity studies may have partly originated because H' has generally been used to estimate diversity and the two components of this index, species density and heterogeneity, respond in opposite fashion to productivity for small sample sizes. Furthermore, the species density/productivity relationship is probably bell-shaped, despite its apparent lack of a turning point in this study, because the number of species

generally declines when eutrophication occurs in situations of extreme enrichment (Riebesell, 1974; Bakelaar & Odum, 1978; Kondratieff & Simmons, 1982).

A summary of the effects of substrate heterogeneity, productivity and stability is given in Table XXXIX. The generality of these findings can be extended to help explain some of the more problematical patterns of species diversity. For example, the pine forests of California are frequently cited to be species poor communities within a very stable area and the Sonoran plant communities as species rich systems within an unstable environment (Huston, 1979). Richerson and Kwei-lin Lum (1980), however, have shown that the gamma diversity of both total vegetation and trees in the stable coastal Californian regions, which encompass the pine forests, is high while the gamma diversity of desert communities is low. Subjective assessment of diversity on a local scale would more likely reflect the heterogeneity than the species density. Heterogeneity is predicted to be negatively correlated with productivity (which is extremely low in deserts but high in pine forests) and hence be greater for desert vegetation than coastal forests. Furthermore, deep sea benthic communities would be expected to have high heterogeneities, resulting from the low productivity, and a low species density. Unfortunately, the diversity of deep sea benthos has generally been calculated using species richness indices (Sanders, 1968; Rex, 1981) which, although positively correlated with heterogeneity, can be positively or negatively correlated with species density. Nevertheless, heterogeneity is certainly very high in the deep sea. However contrary to predictions, Jumars (1976) used five $0.25m^2$ box cores to collect totals of 314 and 162 species of macrofauna from two abyssal sites and it thus appears that the species density is also considerable.

Table XXXIX. The effects of environmental factors on phytal assemblage diversity parameters (++ strong positive relationship, + weak positive relationship, ∩ relationship is maximal at moderate levels, - weak negative association, -- strong negative association).

	Animal Abundance	Heterogeneity	Species Density (Gamma Scale)	Species Densit (Alpha Scale)
Productivity	++	--	+	
Habitat Complexity	+	+	++	+
Environmental Disturbance		∩	∩	∩

A major failing in using the summarised findings shown in Table XXXIX as a predictive model is that evolutionary events have not been considered. Recent studies have questioned the long held equilibrium approach to diversity, whereby the number of species entering an area is assumed to approximately equal the number departing (either by extinction or emigration), and have considered whether non-equilibrium conditions hold (Huston, 1979). The large number of fish species existing in the freshwater lakes of Africa (over 600 endemic species in Lakes Malawi, Tanganyika and Victoria, Fryer, 1972) in environments lacking the structural complexity of coral reefs is a strong indication that ecosystems are capable of maintaining greater numbers of species than presently occur. It seems likely that communities in stable environments (such as the deep sea) will accumulate species over an evolutionary time period (Sanders, 1968). Hence species density would not only be a function of structural complexity and productivity but also the rate of immigration of animals, the diversity of immigrants, the intensity of disturbance and the period of stability since past disturbance.

Using the predictions outlined in Table XL, which are extensions of the results summarised in Table XXXIX, the diversity of tropical rain forests and coral reefs would be explained largely in terms of evolutionary stability. Although this hypothesis appears to be incompatible with an hypothesis of Connell (1978) that disturbance maintains the diversity of tropical areas, Connell's disturbance hypothesis is postulated to occur on a relatively short time scale of tens of years while Sanders' stability hypothesis would probably occur over periods greater than ten thousand years. Consequently, the two hypotheses are not exclusive. It should be noted, however, that Connell's hypothesis would only explain localised patterns as his postulated source of disruption (cyclones) does not occur on the equator (the latitude of the

Table XL. The postulated effects of environmental factors on the diversity of animal communities (++ strong positive relationship, + weak positive relationship, ∩ relationship is maximal at moderate levels, - weak negative association, -- strong negative association).

	Animal Abundance	Heterogeneity	Species Density (Gamma Scale)	Species Densit (Alpha Scale)
Productivity	++	--	∩	∩
Habitat Complexity	+	+	++	+
Environmental Disturbance:				
Ecological Time Scale		∩	∩	∩
Evolutionary Time Scale		+	+	++
Abundance of Immigrants			--	--
Species Density of Immigrants			++	++

Bornean and Amazonian rainforests). One further possible reason for the great species density of tropical communities relates to the diversity of immigrants. Assuming that stable environments can assimilate new species over an evolutionary time period, then the number of new species entering the environment becomes important. Archipelagos, such as the frequently cited Galapagos Islands (Hamilton & Rubinoff, 1963, 1967), have long been recognized to be important centres for speciation because of the barriers to dispersal between islands (Mayr, 1963). As greater numbers of islands are present in tropical compared to temperate areas, because coral reefs are capable of growing to low water mark despite subsidence of the bedrock, rates of speciation would be expected to be greater in the tropics. It is therefore not surprising that Sale (1980) found that the gamma species density of coral reef fishes showed a much better correlation with the distance from the Philippines than with latitude. The greatest concentration of islands in the world occurs in the area bounded by the Philippines, Indonesia and New Guinea. Similar gradients of decreasing species density away from this region have also been found for groups of marine organisms as varied as seagrasses, mangroves and hermatypic corals (McCoy & Heck, 1976) and molluscs (Ladd, 1960; Kohn & Nybakken, 1975).

Further testing of the predictions outlined in Table XL will probably show that some of the factors considered important in this study have only minor influences on diversity, and that other factors are also involved. However, it seems clear that the diversity of an area is a complex function of a number of variables. Consequently, a general theory of ecological diversity, which allows the diversity of habitats on a local scale to be predicted with accuracy, will probably never emerge. Nevertheless, more precision in the

definition of diversity, and the separation of dominance from the alpha and gamma components of species density, might have prevented much of the confusion about the causes of diversity in past studies.

REFERENCES

Abele, L.G., 1974. Species diversity of decapod crustaceans in marine habitats. Ecology, Vol. 55, pp. 156-161.

Alatalo, R.V., 1981. Problems in the measurement of evenness in ecology. Oikos, Vol. 37, pp. 199-204.

Alldredge, A.L., & J.M. King, 1980. Effects of moonlight on the vertical migration patterns of demersal zooplankton. J. Exp. Mar. Biol. Ecol., Vol. 44, pp. 133-156.

Bakelaar, R.G., & E.P. Odum, 1978. Community and population level responses to fertilization in an old field ecosystem. Ecology, Vol. 59, pp. 660-665.

Barnard, J.L., 1972. Gammaridean Amphipoda of Australia, Part 1. Smithsonian Contr. Zool., No. 103, 333 pp.

Barnard, J.L., 1974. Gammaridean Amphipoda of Australia, Part 2. Smithsonian Contr. Zool., No. 139, 148 pp.

Berger, W.H., & F.L. Parker, 1970. Diversity of planktonic Foraminifera in deep-sea sediments. Science, Vol. 168, pp. 1345-1347.

Birch, D.W., 1981. Dominance in marine ecosystems. Am. Nat., Vol. 118, pp. 262-274.

Bousfield, E.L., 1973. Shallow-water gammaridean Amphipoda of New England. Cornell University Press, 312 pp.

Brauner, J.F., 1975. Seasonality of epiphyte algae on Zostera marina at Beaufort, North Carolina. Nova Hedwigia, Vol. 25, pp. 125-133.

Buzas, M.A., 1967. An application of canonical analysis as a method for comparing faunal areas. J. Anim. Ecol., Vol. 36, pp. 563-577.

Caine, E.A., 1974. Comparative functional morphology of feeding in three species of caprellids (Crustacea, Amphipoda) from the northwestern Florida Gulf coast. J. Exp. Mar. Biol. Ecol., Vol. 15, pp. 81-96.

Caine, E.A., 1977. Feeding mechanisms and possible resource partitioning of the Caprellidae (Crustacea: Amphipoda) from Puget Sound, U.S.A. Mar. Biol., Vol. 42, pp. 331-336.

Colman, J., 1940. On the faunas inhabiting intertidal seaweeds. J. Mar. Biol. Assoc. U. K., Vol. 24, pp. 129-183.

Commito, J.A., 1982. Importance of predation by infaunal polychaetes in controlling the structure of a soft-bottom community in Maine, U.S.A. Mar. Biol., Vol. 68, pp. 77-81.

Connell, J.H., 1961. The influence of interspecific competition and other factors on the distribution of the barnacle Chthamalus stellatus. Ecology, Vol. 42, pp. 710-723.

Connell, J.H., 1963. Territorial behaviour and dispersion in some marine invertebrates. Res. Pop. Ecol., Vol. 5, pp. 87-101.

Connell, J.H., 1978. Diversity of tropical forests and coral reefs. Science, Vol. 199, pp. 1302-1316.

Connell, J.H., & E. Orias, 1964. The ecological regulation of species diversity. Am. Nat., Vol. 98, pp. 399-441.

Conover, J.T., 1958. Seasonal growth of benthic marine plants as related to environmental factors in an estuary. Publs Inst. Mar. Sci. Univ. Texas, Vol. 5, pp. 97-147.

Conover, J.T., 1964. The ecology, seasonal periodicity, and distribution of benthic plants in some Texas lagoons. Botanica Marina, Vol. 8, pp. 4-41.

Dahl, A.H., 1973. Surface area in ecological analysis: quantification of benthic coral reef algae. Mar. Biol., Vol. 23, pp. 239-249.

Dahl, E., 1948. On the smaller Arthropoda of marine algae, especially in the polyhaline waters off the Swedish west coast. Unders. över Öresund., Vol. 35, pp. 1-193.

Dayton, P.K., 1971. Competition, disturbance, and community organisation: the provision and subsequent organisation of space in a rocky intertidal community. Ecol. Monogr., Vol. 41, pp. 351-389.

De Benedictis, P.A., 1973. On the correlation between certain diversity indices. Am. Nat., Vol. 107, pp. 295-302.

De Wreede, R.E., 1976. The phenology of three species of Sargassum (Sargassaceae, Phaeophyta) in Hawaii. Phycologia, Vol. 15, pp. 175-184.

Dobzhansky, T., 1950. Evolution in the tropics. Am. Sci., Vol. 38, pp. 209-221.

Eastop, V.F., 1972. Deductions from the present day host plants of aphids and related insects. In, Insect/plant relationships, edited by H.F. van Emden, Symp. Roy. Ent. Soc., No. 6, pp. 157-178.

Edgar, G.J., 1981. An initial survey of potential marine parks in Tasmania. Nat. Parks Wildl. Serv. Occ. Pap., No. 4, pp. 1-87.

Fauchald, K., & Jumars, P.A., 1979. The diet of worms: a study of polychaete feeding guilds. Oceanogr. Mar. Biol. Ann. Rev., Vol. 17, pp. 193-284.

Fenchel, T.M., & S. Kolding, 1979. Habitat selection and distribution patterns of five species of the amphipod genus Gammarus. Oikos, Vol. 33, pp. 316-322.

Fenwick, G.D., 1976. The effect of wave exposure on the amphipod fauna of the alga Caulerpa brownii. J. Exp. Mar. Biol. Ecol., Vol. 25, pp. 1-18.

Fincham, A.A., 1974. Periodic swimming behaviour of amphipods in Wellington Harbour. N.Z. J. Mar. Freshw. Res., Vol. 8, pp. 505-521.

Fryer, G., 1972. Conservation of the Great Lakes of East Africa: a lesson and a warning. Biol. Conserv., Vol. 4, pp. 256-262.

Futuyma, D.J., & F. Gould, 1979. Associations of plants and insects in a deciduous forest. Ecol. Monogr., Vol. 49, pp. 33-50.

Gauld, D.T., & J.B. Buchanan, 1956. The fauna of sandy beaches in the Gold Coast. Oikos, Vol. 7, pp. 293-303.

Gilat, E., 1962. The benthic Amphipoda of the Mediterranean coast of Israel. II. Ecology and life history. Bull. Res. Counc. Israel, Vol. 11B, pp. 71-92.

Gore, R.H., E.E. Gallaher, L.E. Scotto & K.A. Wilson, 1981. Studies on decapod crustacea from the Indian River region of Florida. XI. Community composition, structure, biomass and species areal relationships of seagrass and drift algae-associated macrocrustaceans. Estuar. Coastal Shelf Sci., Vol. 12, pp. 485-508.

Grassle, J.F., G.P. Patil, W.K. Smith, & C. Taillie, 1979. Ecological diversity in theory and practice. Int. Coop. Publ. House, Fairland, Maryland.

Hagerman, L., 1966. The macro- and micro-fauna associated with Fucus serratus L., with some ecological remarks. Ophelia Vol. 3, pp. 1-43.

Hamilton, T.H., & I. Rubinoff, 1963. Isolation, endemism and the multiplication of species in the Darwin finches. Evolution, Vol. 17, pp. 388-403.

Hamilton, T.H., & I. Rubinoff, 1967. On predicting insular variation in endemism and sympatry for the Darwin finches in the Galapagos archipelago. Am. Nat., Vol. 101, pp. 161-172.

Hammer, R.M., 1981. Day-night differences in the emergence of demersal zooplankton from a sand substrate in a kelp forest. Mar. Biol., Vol. 62, pp. 275-280.

Harrod, J.J., & R.E. Hall, 1962. A method for determining the surface areas of various aquatic plants. Hydrobiologia, Vol. 20, pp. 173-178.

Heck, K.L., & R.J. Orth, 1980. Seagrass habitats: the roles of habitat complexity, competition and predation in structuring associated fish and motile macroinvertebrate assemblages. In, Estuarine perspectives, edited by V.S. Kennedy, Academic Press, New York, pp. 449-464.

Heck, K.L., & T.A. Thoman, 1981. Experiments on predator-prey interactions in vegetated aquatic habitats. J. Exp. Mar. Biol. Ecol., Vol. 53, pp. 125-134.

Heck, K.L., G. van Belle, & D. Simberloff, 1975. Explicit calculation of the rarefaction diversity measurement and the determination of sufficient sample size. Ecology, Vol. 56, pp. 1459-1461.

Heip, C., 1974. A new index for measuring evenness. J. Mar. Biol. Ass. U. K., Vol. 54, pp. 555-557.

Heip, C. & P. Engels, 1974. Comparing species diversity and evenness indices. J. Mar. Biol. Ass. U. K., Vol. 54, pp. 559-563.

Hicks, G.R.F., 1977. Species associations and seasonal population densities of marine phytal harpacticoid copepods from Cook Strait. N. Z. J. Mar. Freshw. Res. Vol. 11, pp. 621-643.

Hicks, G.R.F., 1979. Pattern and strategy in the reproductive cycles of benthic harpacticoid copepods. In, Cyclic phenemona in marine plants and animals, edited by E. Naylor & R.G. Hartnoll, Pergamon Press, Oxford, pp. 139-147.

Hicks, G.R.F., 1980. Structure of phytal harpacticoid copepod assemblages and the influence of habitat complexity and turbidity. J. Exp. Mar. Biol. Ecol., Vol. 44, pp. 157-192.

Hill, M.O. 1973. Diversity and evenness: a unifying notation and its consequences. Ecology, Vol. 54, pp. 427-432.

Hines, A.H., 1982. Coexistence in a kelp forest: size, population dynamics, and resource partitioning in a guild of spider crabs (Brachyura: Majidae). Ecol. Monogr., Vol. 52, pp. 179-198.

Horton, R.E., 1945. Erosional development of streams and their drainage basins. Bull. Geol. Soc. Am., Vol. 56, pp. 275-370.

Hurlbert, S.H., 1971. The nonconcept of diversity: a critique and alternative parameters. Ecology, Vol. 52, pp. 577-586.

Huston, M., 1979. A general hypothesis of species diversity. Am. Nat., Vol. 113, pp. 81-101.

Hutchinson, G.E., 1959. Homage to Santa Rosalia or why are there so many kinds of animals. Am. Nat., Vol. 93, pp. 145-159.

Jansson, A-M., 1967. The food web of the Cladophora belt fauna. Helgolander Wiss. Meeresunters, Vol. 15, pp. 574-588.

Jansson, A-M. 1974. Community structure, modelling and simulation of the Cladophora ecosystem in the Baltic Sea. Contr. Asko Lab. Univ. Stockholm, Vol. 5, pp. 1-130.

Jansson, A-M, & A-S, Matthieson, 1971. The ecology of young Idotea in the Baltic. Proc. IVth European Marine Biology Symposium, edited by Crisp, D.J., Cambridge University Press, pp. 71-88.

Jansson, B.-O., & C. Kallander, 1968. On the diurnal activity of some littoral peracarid crustaceans in the Baltic Sea. J. Exp. Mar. Biol. Ecol., Vol. 2, pp. 24-36.

Janzen, D.H., 1973a. Sweep samples of tropical foliage insects: description of study sites, with data on species abundances and size distributions. Ecology, Vol. 54, pp. 659-686.

Janzen, D.H., 1973b. Sweep samples of tropical foliage insects: effects of seasons, vegetation types, elevation, time of day, and insularity. Ecology, Vol. 54, pp. 687-708.

Jephson, N.A., & P.W.G. Gray, 1977. Aspects of the ecology of Sargassum muticum (Yendo) Fensholt, in the Solent region of the British Isles. I. The growth cycle and epiphytes. In, Biology of benthic organisms, edited by Keegan, B.F., P.O. Ceidigh, and P.J.S. Boaden, Pergamon, New York, PP. 367-375.

Jones, D.J., 1973. Variation in the trophic structure and species composition of some invertebrate communties in polluted kelp forests in the North Sea. Mar. Biol., Vol. 20, pp. 351-365.

Jumars, P.A., 1976. Deep-sea diversity: does it have a characteristic scale. J. Mar. Res., Vol. 34, pp. 217-246.

Kitching, J.A., T.T. Macan, & H.C. Gilson, 1934. Studies in sublittoral ecology. I. A submarine gully in Wembury Bay, South Devon. J. Mar. Biol. Assoc. U.K., Vol. 19, pp. 677-705.

Kohn, A.J., & J.W. Nybakken, 1975. Ecology of Conus on Eastern Indian Ocean fringing reefs: diversity of species and resource utilization. Mar. Biol., Vol. 29, pp. 211-234.

Kolding, S., 1981. Habitat selection and life cycle characteristics of five species of the amphipod genus Gammarus in the Baltic. Oikos, Vol. 37, pp. 173-178.

Kolding, S., & T.M. Fenchel, 1979. Coexistence and life cycle characteristics of five species of the amphipod genus Gammarus. Oikos, Vol. 33, pp. 323-327.

Kondratieff, P.F., & G.M. Simmons, 1982. Nutrient retention and macroinvertebrate community structure in a small stream receiving sewage effluent. Arch. Hydrobiol., Vol. 94, pp. 83-98.

Kempton, R.A., & C.R. Taylor, 1976. Models and statistics for species diversity. Nature, Vol. 262, pp. 818-820.

Kempton, R.A., & R.W.M. Wedderburn, 1978. A comparison of three measures of species diversity. Biometrics, Vol. 34, pp. 25-37.

Ladd, H.S., 1960. Origin of the Pacific island molluscan fauna. Amer. J. Sci., Vol. 258A, pp. 137-150.

Lappalainen, A., G. Hallfors, & Kangas, P., 1977. Littoral benthos of the Northern Baltic Sea. IV. Pattern and dynamics of macrobenthos in a sandy-bottom Zostera marina community in Tvarminne. Int. Revue Ges. Hydrobiol., Vol. 62, 465-503.

Ledoyer, M., 1964. Les migrations nycthémérales de la faune vagile au sein des Herbiers de Zostera marina de la zone intertidale en Manche et comparaison avec les migrations en Méditerranée. Rec. Trav. Sta. Mar. Endoume, Vol. 34, pp. 241-249.

Ledoyer, M., 1969. Écologie de la faune vagile des biotopes Méditerranéens accessibles en scaphandre autonome. V - Étude des phénomènes nycthéméraux. Les variations nycthémérales des populations animales dans les biotopes. Tethys, Vol. 1, pp. 291-308.

Luckhurst, B.E., & K. Luckhurst, 1978. Analysis of the influence of substrate variables on coral reef fish communities. Mar. Biol., Vol. 49, pp. 317-323.

MacArthur, R.H., 1964. Environmental factors affecting bird diversity. Am. Nat., Vol. 98, pp. 387-397.

MacArthur, R.H., 1965. Patterns of species diversity. Biol. Rev., Vol. 40, 510-533.

McCloskey, L.R., 1970. The dynamics of the community associated with a marine scleractinian coral. Int. Rev. Ges. Hydrobiol., Vol. 55, pp. 13-81.

McCoy, E.D., & K.J. Heck, 1976. Biogeography of corals, seagrasses and mangroves: an alternative to the centre of origin concept. Syst. Zool., Vol. 25, pp. 201-210.

McIntosh, R.P., 1967. An index of diversity and the relation of certain concepts to diversity. Ecology, Vol. 48, pp. 392-404.

McKenzie, J.D., & P.G. Moore, 1981. The microdistribution of animals associated with the bulbous holdfasts of Saccorhiza polyschides (Phaeophyta). Ophelia, Vol. 20, pp. 201-213.

Magre, E.J., 1974. Ulva lactuca L. negatively affects Balanus balanoides (L.) (Cirripedia Thoracica) in tidepools. Crustaceana, Vol. 27,- 231-234.

Makkaveeva, E.B., 1979. Invertebrates of seaweed beds in the Black Sea (In Russian). Kiev Navkova Dunica, 227 pp.

Margalef, R., 1967. Some concepts relative to the organization of plankton. Oceanogr. Mar. Biol. Ann. Rev., Vol. 5, pp. 257-289.

Margalef, R., 1969. Diversity and stability: a practical proposal and model of interdependence. Brookhaven Symp. Biol., Vol. 22, pp. 25-37.

Margalef, R., 1972. Homage to Evelyn Hutchinson, or why there is an upper limit to diversity. Trans. Conn. Acad. Arts Sci., Vol. 44, pp. 211-235.

Matthews, J.H., & A. Volframs, 1978. Investigating the physical aspects of bays and estuaries: a study of the hydrology and hydrodynamics of North West Bay. Univ. Tas. Environ. Stud. Occ. Pap., No. 7, pp. 1-196.

May, R.M., 1975. Patterns of species abundance and diversity. In, Ecology and evolution of communities, edited by M.L. Cody, & J.M. Diamond, Harvard University Press, pp. 81-120.

Mayr, E., 1963. Animal species and evolution, Harvard University Press, Cambridge, Mass., 797 pp.

Menhinick, E.F., 1964. A comparison of some species-individuals diversity indices applied to samples of field insects. Ecology, Vol. 45, pp. 859-861.

Menhinick, E.F., 1967. Structure, stability and energy flow in plants and arthropods in a sericea lespedeza stand. Ecol. Monogr., Vol. 37, pp. 255-272.

Mills, E.L., 1967. The biology of an ampeliscid amphipod crustacean sibling species pair. J. Fish. Res. Bd Can., Vol. 24, pp. 304-355.

Montouchet, P.C.G., 1979. Sur la communauté des animaux vagile associés à Sargassum cymosum C. Agardh, à Ubatuba, Etat de São Paulo, Brésil. Stud. Neotropical Fauna Envir., Vol. 14, pp. 33-64.

Moore, P.G., 1973a. The kelp fauna of north-east Britain. II. Multivariate classification; turbidity as an ecological factor. J. Exp. Mar. Biol. Ecol., Vol. 13, pp. 127-163.

Moore, P.G., 1973b. The larger crustacea associated with holdfasts of kelp (Laminaria hyperborea) in North-East Britain. Cah. Biol. Mar., Vol. 14, 493-518.

Moore, P.G., 1974. The kelp fauna of north-east Britain. III. Qualitative and quantitative ordinations, and the utility of a multivariate approach. J. Exp. Mar. Biol. Ecol., Vol. 16, pp. 257-300.

Moore, P.G., 1977. Organisation in simple communities: observations on the natural history of Hyale nilssoni (Amphipoda) in high littoral seaweeds. In, Biology of benthic organisms, edited by Keegan, B.F., P.O.Ceidigh, & P.J.S. Boaden, Pergamon, New York, pp. 443-451.

Mukai, H., 1971. The phytal animals on the thalli of Sargassum serratifolium in the Sargassum region, with reference to their seasonal fluctuations. Mar. Biol., Vol. 8, pp. 170-182.

Munro, I.S.R., 1958. The fishes of the New Guinea region. Terr. Papua N. Guinea Fish. Bull., No. 1, 369 pp.

Murdoch, W.W., F.C. Evans, & C.H. Peterson, 1972. Diversity and pattern in plants and insects. Ecology, Vol. 53, pp. 819-829.

Nagle, J.S., 1968. Distribution of the epibiota of macroepibenthic plants. Contr. Mar. Sci. Univ. Texas, Vol. 13, pp. 105-144.

Nelson, W.G., 1979a. Experimental studies of selective predation on amphipods: consequences for amphipod distribution and abundance. J. Exp. Mar. Biol. Ecol., Vol. 38, pp. 225-245.

Nelson, W.G., 1979b. An analysis of structural pattern in an eelgrass (Zostera marina L.) amphipod community. J. Exp. Mar. Biol. Ecol., Vol. 39, pp. 231-264.

Nelson, W.G., 1980. The biology of eelgrass (Zostera marina L.) amphipods. Crustaceana, Vol. 39, pp. 59-89.

Norton, T.A., 1971. An ecological study of the fauna inhabiting the sublittoral marine alga Saccorhiza polyschides (Lightf.) Batt. Hydrobiologia, Vol. 37, pp. 215-231.

Nyan Taw & D.A. Ritz, 1979. Influence of subantarctic and subtropical water on the zooplankton and hydrology of waters adjacent to the Derwent River estuary, south-eastern Tasmania. Aust. J. Mar. Freshw. Res., Vol. 30, pp. 179-202.

Paine, R.T., 1966. Food web complexity and species diversity. Am. Nat., Vol. 100, pp. 65-75.

Peattie, M.E., & R. Hoare, 1981. The sublittoral ecology of Menai Strait. II. The sponge Halichondria panicea (Pallas) and its associated fauna. Estuar. Coastal Shelf Sci., Vol. 13, pp. 621-635.

Peet, R.K., 1974. The measurement of species diversity. Ann. Rev. Ecol. Syst., Vol. 5, pp. 285-307.

Peet, R.K., 1975. Relative diversity indices. Ecology, Vol. 56, pp. 496-498.

Penhale, P.A., 1977. Macrophyte-epiphyte biomass and productivity in an eelgrass (Zostera marina L.) community. J. Exp. Mar. Biol. Ecol., Vol. 26, pp. 211-224.

Petersen, C.J.G., 1918. The sea bottom and its production of food. Rep. Dan. Biol. Stn, Vol. 25, pp. 1-62.

Phillips, R.C. & C.P. McRoy, 1980. Handbook of seagrass biology: an ecosystem perspective. Garland STPM Press, New York, 353 pp.

Pianka, E.R., 1966. Latitudinal gradients in species diversity; a review of concepts. Am. Nat., Vol. 100, pp. 33-46.

Pianka, E.R., 1974. Evolutionary ecology. Harper & Row, New York, 356 pp.

Pielou, E.C., 1966a. The measurement of diversity in different types of biological collections. J. Theor. Biol., Vol. 13, pp. 131-144.

Pielou, E.C., 1966b. Shannon's formula as a measure of specific diversity: its use and misuse. Am. Nat., Vol. 100, pp. 463-465.

Pielou, E.C., 1975. Ecological diversity. Wiley, New York, 165 pp.

Poore, G.C.B., & S. Rainer, 1979. A three year study of benthos of muddy environments in Port Phillip Bay, Victoria. Estuar. Coastal Mar. Sci., Vol. 9, pp. 477-497.

Prince, J.S., 1980. The ecology of Sargassum pteropleuron Grunow (Phaephyceae, Fucales) in the waters of South Florida. II. Seasonal photosynthesis and respiration of S. pteropleuron and comparison of its phenology with that of S. polyceratium Montagne. Phycologia, Vol. 19, pp. 190-193.

Prince, J.S., & S.W. O'Neal, 1979. The ecology of Sargassum pteropleuron Grunow (Phaephyceae, Fucales) in the waters of South Florida. I. Growth, reproduction and population structure. Phycologia, Vol. 18, pp. 109-114.

Rainer, S., 1981. Temporal patterns in the structure of macrobenthic communities of an Australian estuary. Estuar. Coastal Shelf Sci., Vol. 13, 597-620.

Rao, C.R., 1970. Advanced statistical methods in biometric research. Hafner Publishing Company, Darien, Connecticut, 390 pp.

Reish, D.J., 1959. A discussion of the importance of screen size in washing quantitative marine bottom samples. Ecology, Vol. 40, pp. 307-309.

Rex, M.A., 1981. Community structure in the deep-sea benthos. Ann. Rev. Ecol. Syst., Vol. 12, pp. 331-353.

Richerson, P.J., & Kwei-Lin Lum, 1980. Patterns of plant diversity in California: relation to weather and topography. Am. Nat., Vol. 116, pp. 504-536.

Riebesell, J.F., 1974. Paradox of enrichment in competitive systems. Ecology, Vol. 55, pp. 183-187.

Robertson, A.I., & R.K. Howard, 1978. Diel trophic interractions between vertically migrating zooplankton and their fish predators in an eelgrass community. Mar. Biol., Vol. 48, pp. 207-213.

Rohde, K., 1978. Latitudinal gradients in species diversity and their causes. I. A review of the hypotheses explaining the gradients. Zbl. Biol., Vol. 97, pp. 393-403.

Root, R.B., 1973. Organisation of a plant-arthropod association in simple and diverse habitats: the fauna of collards (Brassica oleracea). Ecol. Monogr., Vol. 43, pp. 95-124.

Sale, P.F., 1980. The ecology of fishes on coral reefs. Oceanogr. Mar. Biol. Ann. Rev., Vol. 18, pp. 367-421.

Sanders, H.L., 1968. Marine benthic diversity: a comparative study. Am. Nat., Vol. 102, pp. 243-282.

Sarma, A.L.N., & P.N. Ganapati, 1972. Faunal associations of algae in the intertidal region of Visakhapatnam. Proc. Ind. Nat. Sci. Acad., Vol. 38, pp. 380-396.

Schoener, T.W., 1974. Resource partitioning in ecological communities. Science, Vol. 185, pp. 27-39.

Seal, H., 1964. Multivariate statistical analysis for biologists. Methuen, London, 209 pp.

Sheldon, A.L., 1969. Equitability indices: dependence on the species count. Ecology, Vol. 50, pp. 466-467.

Sheppard, C.R.C., D.J. Bellamy, & Sheppard, A.L.S., 1980. Study of the fauna inhabiting the holdfasts of Laminaria hyperborea (Gunn.) Fosl. along some environmental and geographical gradients. Mar. Envir. Res., Vol. 4, pp. 25-51.

Shin, P.K.S., 1982. Multiple discriminant analysis of macrobenthic infaunal assemblages. J. Exp. Mar. Biol. Ecol., Vol. 59, pp. 39-50.

Simberloff, D.S., 1979. Rarefaction as a distribution-free method of expressing and estimating diversity. In, Ecological diversity in theory and practice, edited by J.F. Grassle, G.P. Patil, W. Smith, & C. Taillie, International Publishing House, Fairland, Maryland. pp. 159-176.

Simpson, E.H., 1949. Measurement of diversity. Nature, Vol. 163, p 688.

Skutch, A.F., 1926. On the habits and ecology of the tube-building amphipod Ampithoe rubricata Montagu. Ecology, Vol. 7, pp. 481-502.

Sloan, N.A., 1982. Size and structure of echinoderm populations associated with different coexisting coral species at Aldabra Atoll, Seychelles. Mar. Biol., Vol. 66, pp. 67-75.

Smith, W., J.F. Grassle, & D. Kravitz, 1979. Measures of diversity with unbiased estimates. In, Ecological diversity in theory and practice, edited by J.F. Grassle, G.P. Patil, W. Smith, & C. Taillie, International Publishing House, Fairland, Maryland, pp. 177-191.

Snedecor, G.W. & W.G.Cochran, 1967. Statistical methods, 6th Ed., Iowa State University Press, 593 pp.

Steel, R.G.D., & J.H. Torrie, 1980. Principles and procedures of statistics. A biometrical approach. 2nd Ed, McGraw Hill, London, 633 pp.

Steele, D.H., & V.J. Steele, 1975. The biology of Gammarus (Crustacea, Amphipoda) in the northwestern Atlantic. XI. Comparison and discussion. Can. J. Zool., Vol. 53, pp. 1116-1126.

Stephenson, W., W.T. Williams, & G.N. Lance, 1970. The macrobenthos of Moreton Bay. Ecol. Monogr., Vol. 40, 459-494.

Stoner, A.W., 1979. Species-specific predation on amphipod crustacea by the pinfish Lagodon rhomboides: mediation by macrophyte standing crop. Mar. Biol., Vol. 55, pp. 201-207.

Stoner, A.W., 1980. Perception and choice of substratum by epifaunal amphipods associated with seagrasses. Mar. Ecol. Prog. Ser., Vol. 3, pp. 105-111.

Stoner, A.W. 1982. The influence of benthic macrophytes on the foraging behavior of pinfish, Lagodon rhomboides (Linnaeus). J. Exp. Mar. Biol. Ecol., Vol. 58, pp. 271-284.

Thiel, H., 1975. The size structure of the deep sea benthos. Int. Rev. Ges. Hydrobiol., Vol. 60, pp. 575-606.

Thorson, G., 1957. Bottom communities. In, Treatise on marine ecology and paleoecology, Edited by J.W. Hedgpeth, Mem. Geol. Soc. Am. 67, Vol. 1, pp. 461-534.

Tranter, D.J., & J.D. Kerr, 1977. Further studies of plankton ecosystems in the eastern Indian Ocean III. Numerical abundance and biomass. Aust. J. Mar. Freshw. Res., Vol. 28, pp. 557-583.

Van Dolah, R.F., 1978. Factors regulating the distribution and population dynamics of the amphipod Gammarus palustris in an intertidal saltmarsh community. Ecol. Monogr., Vol. 48, pp. 191-217.

Vince, S., I. Valiela, N. Backus, & J.M. Teal, 1976. Predation by the salt marsh killifish Fundulus heteroclitus (L.) in relation to prey size and habitat structure: consequences for prey distribution and abundance. J. Exp. Mar. Biol. Ecol., Vol. 23, pp. 255-266.

Warmke, G.L., & L.R. Almódovar, 1963. Some associations of marine molluscs and algae in Puerto Rico. Malacologia, Vol. 1, 163-177.

Warwick, R.M., 1977. The structure and seasonal fluctuations of phytal marine nematode associations on the Isles of Scilly. In, Biology of benthic organisms, edited by Keegan, B.F., P.O. Ceidigh, & P.J.S. Boaden, Pergamon, New York, pp. 577-585.

Watling, L., P.C. Kinner, & D. Maurer, 1978. The use of species abundance estimates in marine benthic studies. J. Exp. Mar. Biol. Ecol., Vol. 35, pp. 109-118.

Whittaker, R.H., 1972. Evolution and the measurement of diversity. Taxon, Vol. 21, pp. 213-251.

Wieser, W., 1951. Über die quantitative Bestimmung der Algen bewohnenden Mikrofauna Felsinger Meereskusten. Oikos, Vol. 3, pp. 124-131.

Wieser, W., 1959. Zur Ökologie der Fauna mariner Algen mit besonderer Berücksichtigung des Mittelmeeres. Int. Revue Ges. Hydrobiol., Vol. 44, pp. 137-180.

Wigham, G.D., 1975. The biology and ecology of Rissoa parva (da Costa) (Gastropoda: Prosobranchia). J. Mar. Biol. Assoc. U. K., Vol. 55, pp. 45-67.

Young, D.K., M.A. Buzas, & M.W. Young, 1976. Species densities of macrobenthos associated with seagrass: a field experimental study of predation. J. Mar. Res., Vol. 34, pp. 577-592.

Appendix 1a. Mean abundances of common animal species (those with total numbers greater than 100) collected from Sargassum verruculosum during 24 hour sampling period.

Animal Species	Hour												
	11.00	13.00	15.00	17.00	19.00	21.00	23.00	1.00	3.00	5.00	7.00	9.00	11.00
Paradexamine churinga	3.7	30	27	1	6	9.3	3	7.3	13	10	23	32	28
Tethygeneia sp.1	3.3	11	6.3	0.7	7	4	1	8.3	5.7	3	7	6	11
Aora hircosa	0	2.7	6.7	0.7	1	2.3	0	1	3	0.3	1.3	1.3	4.3
Ampithoe sp.1	3.7	14	16	5.7	5.3	6.3	3	3	14	15	6.7	5.7	30
Cymadusa sp. 1	0	3.3	1	2.3	1	3	0	2	3.7	7.7	3	1.3	9.7
Raumahara sp.2	5.7	4.3	5	6.7	2.3	1	1.3	1	2	1.7	1	0.7	2.7
Haplocheira barbimana	0.3	0.3	1.3	0	0.3	0.3	0	0	0.7	0	0	0	0
Hydrococcus brazieri	0	0	1.7	0	0.3	0.3	0	0	1	1	0.3	0	2
Diala translucida	6	7.7	3.3	0.7	5.3	9	1	11	3.7	6	14	9.7	33
Pontomyia sp.	22	12	35	8.7	18	10	12	13	14	5.3	19	6.7	17
Munna sp.1	2.7	6.3	3.7	1.3	1.3	0.3	0	9.3	1.7	1	3	2	4
Platynereis dumerillii	14	22	39	15	11	15	5.3	28	22	21	25	26	64
Syllides longocirrata	5.3	9	9	12	7.7	5.3	1.3	3.3	11	8	9	6	11
Pionosyllis sp.	4.3	9.3	5.7	5	3.7	1.3	0.7	4.7	2.7	2.3	4	3	4
Polynoidae A	0	0	2.3	0	0.3	1.3	0	0.3	0	0.3	0	0.7	0.7
Exogone gemmifera	27	37	48	26	39	25	15	20	24	41	29	15	34
Exogone verugera	1	3.3	8.3	4.3	2.7	2.7	1.3	3	3.3	2.7	5.7	2	3.7
Brania rhopalophora	5.3	8.7	11	2.3	9	3	2	3.7	5.7	5	5.3	1.7	4.3
Oligochaete C	5	2	10	8	4.3	3	0.7	4.7	4	2.3	8	3	8
Mean Dry Weight of Algae (g)	2.40	5.41	3.49	4.23	1.88	1.77	0.99	1.43	3.41	4.03	2.11	2.23	4.84

Appendix 1b. Mean abundances of common animals collected from Zonaria turneriana during 24 hour sampling period.

Animal Species	Hour												
	11.00	13.00	15.00	17.00	19.00	21.00	23.00	1.00	3.00	5.00	7.00	9.00	11.00
Paradexamine churinga	3.3	18	5.3	13	5	3	0.3	6.3	2.3	5.3	6	5.7	2
Tethygeneia sp.1	4.7	6	3	7.3	3	0.7	2.7	5.3	1	3.7	6.7	4.7	4
Aora hircosa	0.7	2	9.7	4.3	1	0.3	0.7	5.3	4	3	4	4	2.3
Ampithoe sp.1	2.3	1.7	6	3.3	1.7	0.3	0	0.7	2.7	0.3	0.7	5	1.3
Cymadusa sp.1	0	1.7	1	2.3	1	8.3	0.3	1.3	2.7	0.7	1.7	1	2.3
Raumahara sp.2	10	9	0.3	5	2	2	2.3	2.3	1	1	1.3	4	2.3
Haplocheira barbimana	0.7	1.7	17	12	0	4.3	0.7	3	2	6.7	0.7	7	0.7
Hydrococcus brazieri	0.3	16	26	8	30	11	0.7	0.7	8.3	38	17	0.7	9.3
Diala translucida	0	0	1.3	0.7	0.7	0.7	0	0	2.7	1.3	1.7	1	0.7
Pontomyia sp.	5.3	13	14	19	22	9.7	0.7	8.7	21	23	14	6.7	14
Munna sp.1	5.3	6.3	3	11	2.7	3	1.7	5.3	2.7	3.7	6	6.3	7
Platynereis dumerillii	8.3	25	13	54	33	25	2	35	48	36	38	45	24
Syllides longocirrata	2.3	3.3	3.3	9	0.7	2.3	3.7	3.3	1.7	0.3	1.7	4.7	1.3
Pionosyllis sp.	2.7	13	1	8.7	1.3	3.7	1	6.3	2	4.3	3.7	3.3	5.3
Polynoidae A	0.7	6	12	8.7	4.3	4.3	1.3	4.7	5.7	8.3	7.3	2	12
Exogone gemmifera	11	9.3	6.7	11	6.7	4.7	4.7	6	12	13	6.7	7	7
Exogone verugera	2	9.3	3	4.3	3.7	8	0.3	2.7	9	5	4.3	2.3	2.7
Brania rhopalophora	7	10	0.7	12	3	4.3	4.3	5	6.3	10	8	5.3	4
Oligochaete C	1	3.7	7.7	11	3	0.7	1	1.7	13	12	5	2	14
Mean Dry Weight of Algae (g)	1.83	3.23	3.00	4.54	1.52	2.28	1.40	2.25	2.76	2.31	2.13	1.46	3.05

APPENDIX 2: FANCY POINT SEASONAL DATA

The abundances of phytal animal taxa (rows) associated with each plant (columns) collected during the seasonal sampling program. Animal species are abbreviated in code form (consistent with the taxa in Appendix 3) as follows:
CA 1: Paradexamine churinga, CA 2: Tethygeneia sp.1, CA 3: Aora hircosa,
CA 4: Lembos sp.1, CA 5: Ampithoe sp.1, CA 6: Cymadusa sp.1,
CA 7: Phoxocephalidae B, CA 8: Raumahara sp.2, CA 9: Haplocheira barbimana,
CA 10: Corophium sp.1, CA 11: Dexaminidae A, CA 12: Guernea sp.1,
CA 13: Ampithoe sp.2, CA 15: Phoxocephalidae A, CA 16: Corophidae A,
CA 17: Gabophlias olono, CA 20: Ampithoe sp.3, CA 21: Bircenna sp.,
CA 22: Dexaminidae B, CA 23: Iphinotus sp., CA 24: Guernea sp.2,
CA 25: Cymadusa sp.2, CA 26: Leucothoe sp.1, CA 27: Cymadusa sp.3,
CA 28: Hyale sp., CA 29: Panoplea sp.2, CA 30: Dexaminidae C,
CA 31: Prophliantidae A, CA 32: Colomastix sp.1, CA 33: Panoplea sp.1,
CA 34: Amphilochidae C, CA 35: Phoxocephalidae C, CA 36: Amaryllis sp.,
CA 37: Colomastix sp.2, CA 38: Amphilochidae D, CA 39: Gammaridae C,
CA 41: Phoxocephalidae D, CA 42: Paradexamine sp.4, CA 43: Aora sp.1,
CC 1: Caprella aequilibra, CC 2: Caprella sp.1, CC4: Caprella danilevskii,
CC 6: Caprella sp.2,
CT 1: Paratanais sp.1, CT 2: Paratanais ignotus, CT 3: Apseudes sp.,
CT 4: Leptochelia sp., CT 5: Pagurapseudes sp., CT 6: Tanaid A,
CI 1: Cerceis acuticaudata, CI 2: Dynamenella parva, CI 3: Sphaeromatidae A,
CI 4: Limnoria sp., CI 6: Dynamenella sp., CI 11: Munna sp.1,
CI 12: Munna sp.2, CI 13: Munnidae A, CI 14: Jaeropsis sp.,
CI 15: Jaeropsidae A, CI 16: Iathrippa sp., CI 17: Asellote 2,
CI 18: Antias sp.1, CI 19: Antias sp.2, CI 20: Asellote A, CI 21: Asellote C,
CI 26: Paranthura sp., CI 27: Colanthura sp., CI 29: Malacanthura sp.,
CI 30: Eisothistos sp., CI 31: Paridotea sp., CI 37: Isopod A,
CI 41: Gnathia sp.,
CM 1: Siriella sp., CM 2: Mysid A,
CU 1: Nannastacus inflatus, CU 2: Leuconidae A, CU 2: Leuconidae B,
CU 4: Cumacean A,
CD 1: Macrobrachium intermedium (Stimpson),
CD 2: Parapandalus leptorhynchus (Stimpson), CD 3: Hyppolyte caradina,
CB 1: Halicarcinus ovatus (Stimpson), CB 2: Naxia aurita (Latreille),

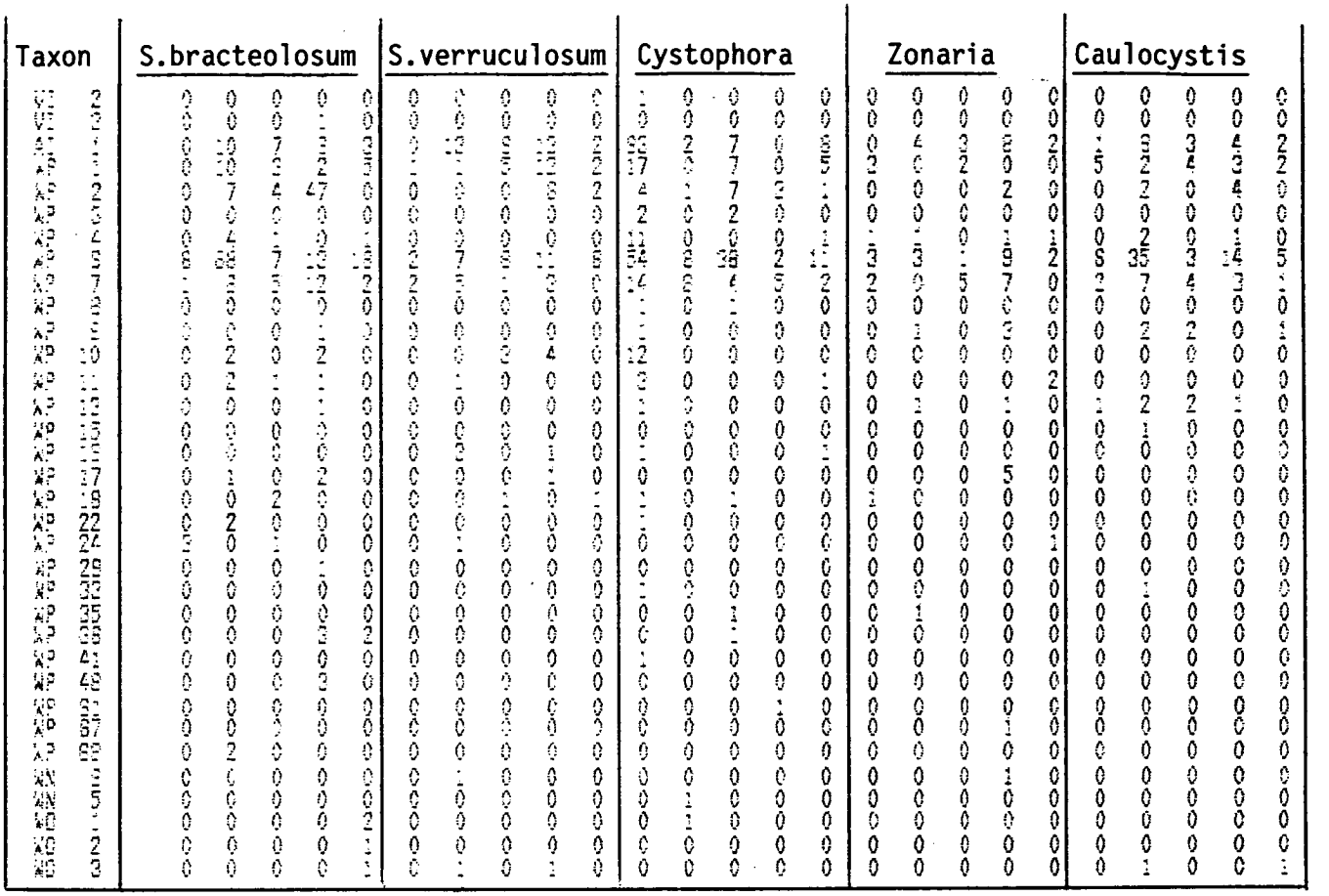
CB 3: Litocheira bispinosa (Kinahan),
CP 1: Pagurid A, CP 2: Pagurid B,
CN 1: Nebalia sp.,
SA 1: Spadella sp., SA 2: Sagitta guileri Taw,
EO 1: Amphipholis squamata,
EE 1: Amblypneustes ovum Lamarck,
EA 1: Tosia australis, EA 2: Coscinasterias calamaria (Gray),
EH 1: Cucumella mutans (Joshua), EH 2: Paracaudina australis (Semper),
EH 3: Psolidium ravum Hickman,
PL 1: Turbellarian A, PL 2: Turbellarian B,
VI 1: Hippocampus breviceps, VI 2: Leptonotus semistriatus,
VI 3: Heteroclinus perspicillatus, VI 4: Stigmatopora argus,
VI 5: Heteroclinus heptaeolus, VI 6: Cristiceps australis,
VI 7: Neoodax balteatus, VI 8: Nesogobius pulchellus,
VI 9: Juvenile fish,
AI 1: Pontomyia sp.,
AP 1: Achelia sp., AP 2: Callipallene sp.,
AP 3: Austrodecus cf tubiferum,
TA 1: Actiniarian A, TA 2: Actiniarian B,
MG 1: Diala lauta, MG 2: Diala monile, MG 3: Scissurella rosea,
MG 4: Phasianotrochus eximinius, MG 5: Macrozafra atkinsoni,
MG 6: Haminoea maugeanensis, MG 7: Hydrococcus brazieri,
MG 8: Diala translucida, MG 9: Notoacmaea corrodenda (May),
MG 10: Hypotrochus monarchus (Crosse & Fischer),
MG 11: Bedeva paivae (Crosse & Fischer),
MG 13: Dentrimitrella lincolnensis (Reeve),
MG 14: Clanculus plebejus (Phillipi), MG 15: Austromitra recurvata (Verco),
MG 16: Cacozeliana granaria (Kiener), MG 17: Cuthona sp.,
MG 18: Noalda exigua (Hedley), MG 19: Lepsiella reticulata (Blainville),
MG 20: Litozamia goldsteini (T.Woods), MG 21: Phasianella australis (Gmelin),
MG 22: Doris cameroni (Allan), MG 24: Dorid A, MG 25: Proximitra pica (Reeve),
MG 26: Acmaeidae A, MG 27: Muricidae A, MG 28: Chemnitzia mariae (T.Woods),
MG 31: Juvenile mollusc 1, MG 32: Chiazacmea crucis (T.Woods),
MG 33: Melanerita melanotragus Smith, MG 34: Rissoidae A,
MG 35: Eatoniella melanochroma (Tate), MG 36: Doriopsilla carneola (Angas),
MG 37: Austraeolis sp., MG 38: Guraleus sp.,

MG 39: Austrococchlea constricta Lamarck,
MG 40: Austromitra scalariformis (T.Woods),
MG 41: Herpetopoma scabriuscula (Adams & Angas),
MG 43: Dentrimitrella pulla (Gaskoin), MG 44: Notomella sp.,
MG 45: Juvenile mollusc 2, MG 46: Dentimitrella sp.1,
MG 48: Anabathron contabulatum Frauenfeld,
MG 49: Amblychilepas nigrita (Sowerby), MG 50: Merelina cheilostoma (T.Woods),
MA 1: Acanthochiton sp.1, MA 2: Acanthochiton sp.2, MA 3: Acanthochiton sp.3,
MA 4: Callochiton elongata May,
MA 5: Sypharochiton pellisserpentis Quoy & Gaimard,
MC 1: Idiosepius sp.,
WP 1: Platynereis dumerilii , WP 2: Syllides longocirrata,
WP 3: Pionosyllis sp., WP 4: Polynoidae A, WP 5: ?Micronereis sp.,
WP 6: Exogone gemmifera, WP 7: Exogone verugera, WP 8: Amphinomid A,
WP 9: Palaeonotus debilis, WP 10: Brania rhopalophora, WP 11: Syllid A,
WP 12: ?Paralacydonia sp., WP 13: Syllidae B, WP 14: Phyllodocidae A,
WP 15: Polychaete A, WP 16: Harmothoe sp.2, WP 17: Bhawania sp.,
WP 18: Syllidae C, WP 20: Syllidae D, WP 21: Syllidae E, WP 22: Syllidae U,
WP 23: Syllidae V, WP 24: Syllidae F, WP 25: Syllidae G, WP 26: ?Nerimyra sp.1,
WP 28: Syllidae W, WP 29: Typosyllis sp.1,
WP 30: Ceratonereis mirabilis Kinberg, WP 31: Phyllodoce sp.1,
WP 32: ?Nerimyra sp.2, WP 33: Phyllodoce sp.2, WP 34: Hesionidae A,
WP 35: Syllidae H, WP 36: Phyllodoce sp.3, WP 37: ?Hesionidae B,
WP 38: Harmothoe sp.2, WP 39: Neanthes vaalii Kinberg,
WP 40: Polychaeta B, WP 41: Syllidae X, WP 42: Syllidae MM, WP 43: Syllidae Y,
WP 44: Hesionidae C, WP 45: Lamellisyllis sp., WP 46: Syllidae Z,
WP 47: Syllidae AA, WP 48: Syllidae BB, WP 49: Syllidae CC, WP 50: Syllidae DD,
WP 51: Autolytus sp.1, WP 52: Syllidae EE, WP 53: Syllidae I,
WP 54: Syllidae FF, WP 55: Syllidae GG, WP 56: Syllidae J, WP 57: Syllidae HH,
WP 59: Syllidae JJ, WP 60: Syllidae K, WP 61: Syllidae KK, WP 62: Syllidae L,
WP 63: Syllidae LL, WP 67: Syllidae MM, WP 68: Syllidae NN,
WO 1: Oligochaete A, WO 2: Oligochaete B, WO 3: Oligochaete C,
WO 4: Oligochaete D, WO 5: Oligochaete E, WO 6: Oligochaete F,
WO 7: Oligochaete G,
WN 1: Nemertean A, WN 2: Nemertean B, WN 3: Nemertean C, WN 4: Nemertean D,
WN 5: Nemertean E, WN 6: Nemertean F, WN 7: Nemertean G.

Appendix 2. Seasonal Data. 4/7/78

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
[illegible]	[illegible]	5	14	5	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	0	2	3	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	[illegible]	[illegible]	[illegible]	2	0	0	0	3	2	0	22	0	2	0
[illegible]	11	22	4	22	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	15	0	8	0	1	3	4	9	1	1	3	1	2
[illegible]	0	2	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	0	[illegible]	0	0	0	1	2	0	7	3	4	[illegible]
[illegible]	17	25	[illegible]	[illegible]	73	17	[illegible]	[illegible]	[illegible]	12	[illegible]	28	[illegible]	5	75	2	0	0	10	0	14	[illegible]	74	55	26
[illegible]	4	[illegible]	2	[illegible]	4	0	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	7	0	20	3	3	4	3	2	0	[illegible]	7	5	7
[illegible]	0	0	0	[illegible]	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	[illegible]	0	0	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	2	0	2	0	0	25	5	7	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	[illegible]	0	0
[illegible]	0	0	0	0	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	2	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	[illegible]
[illegible]	0	2	0	5	4	2	[illegible]	[illegible]	[illegible]	5	0	0	0	0	0	0	0	0	0	0	0	12	4	2	[illegible]
[illegible]	0	0	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	[illegible]	0	0	0	0	0	0	0	0	4	0	[illegible]	0	0	0	0	0	0	0	0	0	0
[illegible]	28	30	2	17	9	0	0	0	[illegible]	0	0	0	[illegible]	0	[illegible]	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	[illegible]	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	[illegible]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	[illegible]	0	0
[illegible]	0	0	0	0	0	2	0	5	0	4	[illegible]	0	[illegible]	0	0	0	0	0	0	0	0	[illegible]	0	0	0
[illegible]	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	25	88	9	109	107	10	46	22	51	8	46	14	81	17	66	3	0	0	0	17	4	244	61	54	19
[illegible]	0	0	2	0	[illegible]	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	50	[illegible]	[illegible]	56	44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	378	29	37	5	112	8	[illegible]	3	0	[illegible]	[illegible]	[illegible]	4	[illegible]	7
[illegible]	[illegible]	10	[illegible]	[illegible]	5	2	15	12	14	[illegible]	18	14	44	0	2	[illegible]	0	0	1	0	2	37	12	5	[illegible]
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0
[illegible]	4	[illegible]	2	[illegible]	0	4	[illegible]	3	8	2	10	[illegible]	24	0	0	0	0	0	0	0	[illegible]	14	12	8	6
[illegible]	7	30	[illegible]	13	55	[illegible]	7	4	[illegible]	5	70	[illegible]	[illegible]	[illegible]	9	0	0	0	3	0	[illegible]	19	4	2	5
[illegible]	0	[illegible]	[illegible]	0	[illegible]	0	0	0	0	0	28	0	0	0	0	0	[illegible]	[illegible]	2	0	0	0	0	0	0
[illegible]	8	[illegible]	0	0	[illegible]	[illegible]	0	0	2	[illegible]	338	4	9	[illegible]	0	17	3	19	7	[illegible]	3	0	[illegible]	2	0
[illegible]	4	14	5	4	16	10	22	15	12	7	82	12	48	6	30	[illegible]	0	0	0	0	13	56	95	45	29
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	[illegible]
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	[illegible]	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	20	0	2	[illegible]	2	0	0	0	0	[illegible]	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0
[illegible]	[illegible]	0	0	[illegible]	0	0	3	0	[illegible]	0	3	0	0	0	[illegible]	0	0	0	0	0	[illegible]	3	0	[illegible]	0
[illegible]	0	[illegible]	0	0	0	0	0	0	[illegible]	0	3	0	0	0	[illegible]	0	0	0	0	0	[illegible]	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Seasonal Data. 4/7/78 (Cont.).



Appendix 2. Seasonal Data. 4/8/78

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
CA	4	1	3	1	2	13	2	3	21	18	19	1	15	1	0	0	1	0	1	0	24	30	12	48	7
CA	0	0	2	0	2	19	1	1	15	12	0	0	12	1	0	0	1	0	0	0	4	3	1	10	5
CA	10	0	10	2	14	17	3	5	10	6	2	0	8	0	3	0	5	3	4	1	5	4	4	14	5
CA	2	0	12	2	6	2	3	5	11	6	4	0	18	0	5	1	2	8	15	1	1	4	4	8	6
CA	21	9	27	12	19	28	4	8	9	21	33	4	89	13	19	2	1	0	5	1	12	9	16	66	24
CA	2	1	2	1	4	5	4	7	2	8	8	1	3	0	2	1	5	0	2	4	3	2	1	14	7
CA	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CA	10	2	17	1	5	1	2	3	1	3	0	0	2	0	1	0	3	1	7	2	0	2	2	9	1
CA	2	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0
CA	0	0	0	0	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	2	4	0	0	7	0	0	0	0	0	0	0	0	1	3	4	2
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CA	4	2	15	0	8	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	2	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	2	0	0	0	0	0	0	2	0	0	1	1	0	0	0	0	0	0	1	2	1	3	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CA	38	37	95	17	38	87	22	34	43	22	10	1	58	38	8	0	6	0	15	3	41	37	73	241	58
CA	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
CA	34	4	74	51	15	11	4	2	6	3	29	0	110	12	18	0	1	0	17	2	18	13	11	44	17
CA	38	4	117	2	28	30	7	4	11	22	12	0	48	42	5	0	0	0	1	0	30	43	8	78	24
CA	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
CA	3	3	8	0	1	2	1	2	1	3	4	0	4	1	0	0	0	0	0	0	0	2	5	0	0
CA	24	9	79	12	19	9	3	7	12	19	12	0	45	3	9	0	1	0	1	1	17	15	41	32	24
CA	1	0	1	0	0	0	0	0	0	1	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0
CA	5	0	20	5	7	3	2	0	1	0	2	0	12	0	5	1	2	8	17	1	0	8	2	2	2
CA	38	9	80	8	47	21	17	14	25	30	25	1	75	28	9	0	1	0	3	1	37	94	29	108	23
CA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	1	0	0	0	0	0	0	0	0	0	1	0	4	1	0	0	0	0	0	0	0	0	0	0	0
CA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0
CA	1	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MA	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	2	0	0	1	2	0	0	0	1	1	0	3	0	0	0	0	0	0	0	0	3	0	0	0
CT	2	2	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CT	1	0	0	4	0	0	5	1	0	2	1	0	1	5	0	1	1	2	1	0	1	0	2	3	0
CT	12	1	0	2	0	0	0	0	0	1	0	3	0	9	0	2	0	0	0	2	0	3	1	2	2
CT	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CT	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CT	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CT	31	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
CT	1	0	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0
CT	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	0	0	0	1	1	3	3	0	2	5	3	1	0	6	0	3	0	0	2	1	2	0	21	6	38	7
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CT	2	4	18	11	0	11	2	0	4	1	30	1	0	5	0	0	0	0	0	0	0	7	6	18	7	5
CT	3	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0	0
CT	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0
CT	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CT	2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0
CT	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	1	0	1	0
CT	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0
PL	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
VI	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0
VI	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AI	1	6	1	5	3	0	12	5	2	5	1	6	0	39	3	3	1	6	12	13	2	3	14	3	19	2
AP	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3	0	0
MP	1	15	17	4	15	4	12	4	2	5	3	18	0	33	8	3	1	4	3	1	0	5	17	14	19	6

Cont.

Seasonal Data. 4/8/78

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
2	2	52	7	22	14	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	2	0	15	2
3	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4	1	3	0	4	2	0	0	0	0	0	1	0	3	0	1	0	1	4	3	0	0	0	0	3	0
5	12	88	15	52	18	33	4	11	15	9	15	4	170	5	3	0	11	5	7	2	0	75	182	342	95
7	5	8	2	0	0	5	6	1	2	0	0	0	14	0	3	0	1	2	4	0	0	3	4	9	12
8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10	0	5	0	0	0	0	3	4	0	2	2	1	1	0	0	0	0	0	2	0	0	2	0	18	8
11	2	21	4	2	0	10	3	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	2	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	1	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
16	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
17	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	3	2	0	0	2	0	0	1	0	0	0	0	2	3	0	0	2	0	0	1
22	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
52	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0

Appendix 2. Seasonal Data. 4/9/78

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				

Seasonal Data. 4/9/78 (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0

Appendix 2. Seasonal Data. 4/10/78.

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									
27																									
28																									
1																									
2																									
3																									
11																									
12																									
13																									
18																									
19																									
20																									
31																									
1																									
2																									
3																									
1																									
2																									
1																									
2																									
1

Seasonal Data. 4/10/78. (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
AP 9	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0
AP 9	1	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2
AP 10	7	5	4	3	21	5	8	12	18	5	33	16	23	1	32	3	21	85	3	16	8	8	4	2	20
AP 11	0	0	0	0	1	2	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	2
AP 12	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
AP 13	0	0	0	1	0	0	0	0	4	0	0	0	0	1	9	0	0	0	1	0	0	0	0	0	1
AP 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
AP 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AP 16	23	79	12	4	18	13	35	15	5	14	88	47	18	0	9	33	75	24	0	53	13	123	3	3	94
AP 19	0	0	0	3	0	0	0	0	3	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0
AP 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AP 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
AP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
AP 31	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0
AP 34	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AP 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
AP 42	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 46	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 47	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 48	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	1	0	0	0	0	0	0
AP 49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
AP 50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
AN 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AN 6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0
AD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
AD 2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AD 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Appendix 2. Seasonal Data. 2/11/78.

Taxon	S.bracteolosum				S.verruculosum				Cystophora				Zonaria				Caulocystis				

Seasonal Data. 2/11/78 (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
[illegible]	3	15	4	0	0	2	2	6	3	12	11	4	17	10	3	3	0	0	0	1	18	19	4	14	12
[illegible]	13	17	0	0	0	2	2	11	3	0	13	5	30	28	0	0	0	1	0	1	15	12	6	46	15
[illegible]	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
[illegible]	0	2	0	0	2	0	1	1	0	3	2	0	0	0	0	1	0	1	2	1	3	0	0	2	4
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
[illegible]	38	38	7	12	0	28	12	47	36	38	28	2	22	25	1	3	1	1	4	7	101	53	9	131	58
[illegible]	3	11	0	0	2	4	8	12	9	13	3	1	8	7	0	9	1	3	3	10	12	16	10	27	27
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
[illegible]	12	15	3	3	6	11	10	22	25	24	15	1	17	15	0	0	2	5	9	8	48	43	3	101	46
[illegible]	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	2	1	0	1	1	0
[illegible]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
[illegible]	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	2	0
[illegible]	2	3	0	0	3	0	2	2	0	3	4	0	1	3	0	0	0	0	1	1	5	4	2	14	12
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0
[illegible]	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	1	1	1	0	1	2	0	3
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
[illegible]	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
[illegible]	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
[illegible]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[illegible]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2
[illegible]	2	1	0	0	1	0	0	8	3	4	2	0	1	9	0	0	0	1	1	0	4	5	5	6	1
[illegible]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Appendix 2. Seasonal Data. 3/12/78.

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
	421	22	97	186	258	85	88	41	151	15	11	148	211	45	81	10	6	0	5	7	250	315	185	186	584
	17	4	15	28	29	7	12	20	14	2	1	10	22	3	4	1	3	0	0	1	32	54	82	37	153
	32	2	25	33	22	3	5	4	10	0	5	12	27	2	0	7	0	0	0	3	2	33	11	36	55
	4	0	2	0	2	0	0	5	2	0	0	0	0	0	0	3	0	2	0	0	0	0	17	1	3
	31	3	18	25	14	3	9	2	9	0	2	11	18	1	16	0	0	0	0	0	17	86	44	27	93
	116	20	85	88	28	7	7	1	28	1	2	20	41	3	11	4	7	3	1	0	57	53	51	47	159
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
	2	0	0	2	2	0	0	0	0	0	0	0	0	0	1	2	2	5	0	0	0	5	12	0	11
	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	2	0	1
	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	2	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	23	0	0	21
	11	25	0	118	7	2	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4	2	2	0	4
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	13	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	2	4	0	0	3	13	1	5	0	0	11	1	0	9	1	0	0	0	0	2	10	5	29	12
	11	52	55	9	0	9	0	2	12	0	1	5	10	5	3	2	0	0	0	0	9	195	15	100	102
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0
	43	17	2	22	15	20	13	16	0	4	25	3	0	5	0	4	0	0	0	39	27	32	2	29	
	3	6	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	2	2	2	4	1	
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
	13	3	24	9	0	4	5	12	1	0	0	2	0	0	0	0	0	0	0	9	31	15	13	44	
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	
	0	0	0	0	1	0	4	10	14	1	0	4	1	0	0	0	2	0	1	0	2	2	13	2	5
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Seasonal Data. 3/12/78 (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2	17	4	7	10	0	12	7	11	0	0	17	0	0	0	0	12	1	2	11	7	11	43	29	13	34
3	32	0	0	15	0	14	11	32	2	0	28	0	15	0	0	6	2	0	0	1	0	0	0	0	0
4	24	28	11	2	0	4	4	8	0	0	28	0	5	3	0	2	1	0	1	0	1	131	36	20	70
5	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	49	19	17	19
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	1
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	1	2
9	15	15	27	30	2	0	4	7	0	0	0	0	2	0	0	3	0	1	1	0	0	83	54	47	49
10	2	0	0	0	0	4	2	7	0	0	4	0	0	0	0	2	4	0	0	0	1	46	16	7	20
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
12	15	11	13	14	0	2	15	12	2	0	0	0	0	0	0	0	5	1	0	4	1	98	83	14	31
13	2	0	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
16	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	1	2	3	2	3
18	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	1	2	2	0	3
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0
38	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
39	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
57	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Appendix 2. Seasonal Data. 4/1/79.

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
[illegible]	[illegible]	263	[illegible]	711	184	[illegible]	229	174	253	151	507	[illegible]	[illegible]	[illegible]	[illegible]	8	[illegible]	2	3	2	570	325	[illegible]	199	507
[illegible]	72	32	27	39	10	[illegible]	22	[illegible]	[illegible]	29	22	0	[illegible]	[illegible]	150	[illegible]	2	0	0	2	75	39	104	35	137
[illegible]	71	42	124	140	50	0	10	7	33	7	39	0	[illegible]	77	103	0	0	3	0	0	35	31	58	8	23
[illegible]	[illegible]	2	[illegible]	5	[illegible]	[illegible]	[illegible]	0	[illegible]	0	[illegible]	2	0	35	[illegible]	0	0	2	0	0	[illegible]	14	25	5	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	0	0	0	0	0	25	[illegible]	52	[illegible]	71
[illegible]	88	[illegible]	[illegible]	[illegible]	58	[illegible]	[illegible]	[illegible]	58	25	54	2	22	[illegible]	257	[illegible]	[illegible]	0	[illegible]	3	[illegible]	51	[illegible]	98	113
[illegible]	0	0	0	[illegible]	[illegible]	2	[illegible]	0	[illegible]	[illegible]	0	0	0	0	2	0	0	0	0	0	13	0	2	6	8
[illegible]	[illegible]	8	4	23	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	3	13	0	11
[illegible]	[illegible]	4	5	7	13	0	0	[illegible]	1	[illegible]	[illegible]	0	0	9	0	0	0	0	0	0	0	1	0	0	2
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1	4	2	0
[illegible]	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	[illegible]	4	0	0	0	1	0	0	1	0	0	0
[illegible]	93	24	44	83	19	0	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	4	15	10	0
[illegible]	[illegible]	0	[illegible]	2	2	[illegible]	[illegible]	[illegible]	0	0	[illegible]	0	0	3	7	0	0	0	0	0	0	2	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
[illegible]	38	15	92	39	23	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
[illegible]	2	0	0	2	0	0	0	0	0	0	0	0	[illegible]	[illegible]	2	0	0	0	0	0	0	0	0	0	0
[illegible]	3	2	0	3	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]
[illegible]	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	[illegible]	0	0	0	0	0	0	0	[illegible]	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
[illegible]	71	7	54	32	15	29	28	13	13	16	17	0	10	12	13	0	0	0	0	0	25	4	24	18	43
[illegible]	27	15	102	80	4	0	0	2	3	0	0	0	0	5	2	0	2	0	0	0	29	6	22	8	32
[illegible]	3	6	[illegible]	2	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	2	0	7	1	0	0
[illegible]	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
[illegible]	42	14	29	11	9	38	33	15	8	22	19	0	16	28	77	0	0	0	1	0	69	25	61	11	21
[illegible]	0	1	4	[illegible]	[illegible]	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	11	0	2
[illegible]	0	[illegible]	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
[illegible]	44	12	35	22	25	21	2	9	15	9	5	0	1	14	30	0	0	0	0	0	34	5	53	12	29
[illegible]	12	[illegible]	8	8	[illegible]	[illegible]	3	0	0	[illegible]	1	0	0	3	2	0	0	0	0	0	17	19	40	1	9
[illegible]	0	0	0	0	0	[illegible]	[illegible]	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	0	0
[illegible]	12	5	[illegible]	2	2	[illegible]	3	[illegible]	7	[illegible]	34	[illegible]	2	49	91	1	0	0	2	1	13	0	34	4	[illegible]
[illegible]	[illegible]	[illegible]	28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	[illegible]	0	0	0	0	3	0	0	0	0	0	16	9	24	7	35
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	[illegible]	0	0	[illegible]	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	2	0	0	0	[illegible]	0	0	[illegible]	3	0	0	0	0	0	0	0	[illegible]	0	0
[illegible]	2	2	[illegible]	0	0	0	0	0	0	2	0	0	0	3	5	0	0	0	0	0	0	2	8	0	0
[illegible]	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0
[illegible]	[illegible]	0	0	0	0	[illegible]	0	0	0	1	[illegible]	0	0	[illegible]	5	0	0	0	0	0	0	2	5	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	2	0	0	0	0	0	0	0	0	1	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
[illegible]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
[illegible]	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	7	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	8	[illegible]	23	8	4	2	0	[illegible]	0	2	0	0	0	1	2	0	0	0	0	0	2	0	9	2	[illegible]
[illegible]	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	34	8	38	40	14	10	4	[illegible]	8	10	15	0	[illegible]	40	[illegible]	[illegible]	0	0	2	[illegible]	14	7	55	9	54
[illegible]	14	3	20	28	8	2	5	4	5	4	2	0	[illegible]	10	9	0	0	0	0	0	[illegible]	[illegible]	8	[illegible]	[illegible]
[illegible]	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	[illegible]	0	[illegible]	0
[illegible]	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	[illegible]	0	0	0	0
[illegible]	0	0	0	0	0	0	0	[illegible]	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0
[illegible]	27	4	15	7	2	7	4	2	9	10	7	[illegible]	4	13	39	2	0	0	0	0	23	6	28	6	21
[illegible]	5	2	[illegible]	8	3	3	5	6	4	[illegible]	8	0	2	23	14	0	0	0	1	0	3	8	12	3	7
[illegible]	2	0	[illegible]	3	0	0	0	0	[illegible]	0	[illegible]	0	0	2	2	0	0	0	0	0	0	1	1	0	[illegible]
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	[illegible]	2	[illegible]	[illegible]	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	3	0	[illegible]	[illegible]	2
[illegible]	0	0	0	[illegible]	0	0	0	0	[illegible]	3	0	0	[illegible]	0	0	0	0	0	0	0	0	0	3	0	[illegible]
[illegible]	0	0	2	[illegible]	[illegible]	0	0	0	0	3	2	0	[illegible]	0	0	0	0	0	0	0	0	0	2	0	0
[illegible]	6	3	0	3	0	0	0	0	0	2	[illegible]	0	0	[illegible]	8	0	[illegible]	0	0	0	0	0	5	0	0
[illegible]	2	[illegible]	0	[illegible]	2	0	0	0	0	2	0	0	0	3	6	0	0	0	0	0	0	1	[illegible]	0	0

Cont.

Seasonal Data. 4/1/79 (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
SA 2	0	0	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
[illegible]	0	0	0	-	-	0	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	1	0	0	0
[illegible]	0	0	0	-	-	0	0	0	-	0	0	0	-	2	0	-	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	-	-	0	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	0	26	0	-
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-	0	0	0	1	0	0	25	0	-
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	1	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
[illegible]	7	4	8	5	7	2	3	3	8	8	2	1	0	17	10	0	2	1	1	4	4	5	20	8	0
[illegible]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0
[illegible]	40	17	43	42	23	14	23	20	20	25	4	1	23	1	52	2	1	4	0	0	30	9	66	12	23
[illegible]	178	88	212	202	97	17	38	12	24	22	14	5	33	35	103	2	0	0	0	0	17	7	29	48	122
[illegible]	10	1	8	13	14	5	18	12	13	1	4	0	12	3	14	0	0	2	0	0	27	1	14	4	13
[illegible]	4	1	2	3	0	1	1	0	0	0	0	0	0	18	17	0	0	0	0	0	2	2	7	1	1
[illegible]	12	4	8	3	4	2	4	4	1	4	4	0	2	12	9	0	0	0	0	0	1	4	3	0	3
[illegible]	170	167	188	138	30	23	9	18	18	12	10	1	22	83	39	2	3	1	5	3	28	37	111	24	91
[illegible]	4	6	13	12	10	9	7	10	4	10	3	0	8	34	30	0	5	1	5	2	24	4	25	8	17
[illegible]	2	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	1	0	1	0	0	3	0	1
[illegible]	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	2	1	3
[illegible] 10	48	32	28	71	8	8	8	9	5	4	8	0	2	30	40	2	8	2	7	2	11	11	48	31	38
[illegible] 11	2	2	8	5	7	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1
[illegible] 12	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0
[illegible] 13	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
[illegible] 14	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
[illegible] 15	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0
[illegible] 16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	4	1	0
[illegible] 18	1	0	0	0	0	2	0	1	0	1	0	0	0	5	2	1	1	0	0	0	1	0	1	1	0
[illegible] 20	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
[illegible] 21	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
[illegible] 22	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	1
[illegible] 24	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 28	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0
[illegible] 29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	2
[illegible] 31	0	1	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0
[illegible] 33	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 34	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 35	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
[illegible] 36	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 37	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	4	0	0
[illegible] 45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 51	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 52	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	-	0	0	0	0	0	0
[illegible] 59	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 60	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 61	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[illegible] 62	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
[illegible] 63	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
[illegible]	0	0	1	-	0	0	0	-	0	-	0	0	0	2	0	0	0	0	1	0	1	0	0	0	0
2	9	4	18	22	0	3	5	2	4	3	3	0	0	30	82	0	1	0	0	1	14	6	31	3	25

Appendix 2. Seasonal Data. 5/2/79.

Taxon		S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
CA	1	1302	356	639	22	971	1201	91	381	429	272	573	1281	987	37	134	36	46	100	138	7	527	184	422	8932	685
CA	2	70	28	31	2	58	91	2	30	28	0	25	3	127	0	3	2	2	10	8	1	20	19	42	96	186
CA	3	114	86	52	3	105	59	2	3	10	24	24	16	118	1	1	0	10	4	5	5	25	3	15	46	100
CA	4	11	1	1	1	12	9	1	6	22	5	1	1	147	0	3	4	18	5	8	10	9	0	5	14	49
CA	5	33	70	5	0	37	39	5	2	3	14	11	1	11	0	1	0	0	0	2	1	26	8	12	10	99
CA	6	142	88	46	5	115	82	7	40	22	46	30	9	117	4	8	7	7	5	12	34	110	48	72	80	233
CA	8	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
CA	9	11	24	14	1	8	1	0	0	3	2	1	0	8	0	0	0	2	3	2	1	3	0	0	16	12
CA	10	10	4	12	0	17	6	1	0	5	3	3	0	20	0	0	0	3	3	0	0	8	1	4	1	23
CA	11	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2	3
CA	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA	13	38	10	11	0	44	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	16
CA	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CA	20	8	35	28	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
CA	21	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
CA	25	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CA	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CA	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
CC	2	29	29	20	10	32	39	1	25	8	11	21	11	21	0	4	0	1	2	1	1	19	2	7	14	27
CI	1	12	22	0	0	9	4	0	0	0	1	0	4	1	0	0	0	0	0	0	0	3	1	1	2	4
CI	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	1	1
CI	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CI	5	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	4	0	0	0	1	0	0	0	1
MG	1	35	18	37	5	45	83	0	24	24	17	32	2	136	0	6	4	11	3	18	3	13	22	52	58	117
MG	2	45	40	21	0	25	19	8	12	2	4	1	1	22	0	0	0	0	0	1	1	14	10	14	22	39
MG	3	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0
MG	4	16	22	11	1	14	15	1	2	5	2	5	1	20	0	2	0	2	0	2	0	4	1	0	10	22
MG	5	11	9	3	1	15	7	0	2	1	1	2	0	5	0	0	0	0	4	1	0	4	0	0	20	15
MG	6	8	0	0	0	1	17	1	0	9	1	0	0	23	0	0	1	0	1	1	0	4	1	9	3	19
MG	7	56	7	21	10	87	191	1	39	66	14	30	6	249	0	5	2	47	15	28	6	21	10	41	43	195
MG	8	32	15	18	8	87	45	4	22	7	37	7	3	35	10	1	1	0	2	2	0	22	14	32	100	149
MG	10	0	0	0	0	1	3	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0
MG	11	1	0	1	0	3	1	0	0	1	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0	1
MG	13	1	0	0	0	0	0	0	1	3	1	1	0	4	0	0	1	0	0	0	0	0	0	0	0	1
MG	15	0	0	0	1	2	1	0	1	1	4	0	1	2	0	0	1	0	0	0	1	0	1	1	2	6
MG	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
MG	17	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
MG	18	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	3	2
MG	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MG	22	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MG	24	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MG	28	0	0	0	0	1	1	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
MG	37	2	0	0	0	0	3	0	0	0	0	0	0	14	0	0	0	1	0	0	0	0	1	0	3	11
MG	41	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MA	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	1	5	0	4	0	3	2	0	0	3	1	0	1	6	0	1	0	0	0	0	0	0	0	7	4	15
CI	2	4	1	1	0	6	3	0	1	0	1	0	0	3	0	0	0	0	0	0	0	0	1	1	1	5
CI	11	5	7	7	1	23	17	2	5	6	3	2	5	11	0	0	0	0	1	1	2	3	2	3	14	35
CI	12	3	4	5	0	12	12	2	2	3	0	4	2	9	0	1	0	0	0	1	0	1	0	2	18	17
CI	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CI	16	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	1
CI	27	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CM	1	25	45	46	3	37	53	2	6	0	5	18	10	23	2	3	1	1	1	6	1	3	5	8	25	39
CU	1	7	2	2	1	8	11	0	12	10	0	1	0	10	1	2	0	0	0	2	0	1	1	3	21	27
CU	2	0	0	0	1	2	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1
CU	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CD	1	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	2	1	3	21	2	10	7	1	7	17	1	1	2	9	1	0	0	0	0	0	0	0	0	3	5	3
CD	3	10	16	9	3	29	23	3	11	1	3	5	3	1	0	1	0	2	1	0	0	7	2	4	6	10
CB	1	0	0	0	0	0	1	0	0	0	0	1	0	2	0	0	1	1	0	0	0	3	0	1	1	0
CB	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
CP	1	0	1	6	1	8	2	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	2
CP	2	0	0	1	0	2	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
ED	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	1
SE	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
EA	1	0	0	0	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
PL	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Cont.

Seasonal Data. 5/2/79. (Cont.).

Taxon		S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
[illegible]	[illegible]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	119	35	82	8	147	241	3	97	50	37	92	5	402	3	22	7	40	17	13	15	93	30	89	121	196
[illegible]	[illegible]	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	1	0	0	5
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	1	140	95	97	5	108	144	15	43	38	32	87	9	181	9	13	8	5	10	20	2	29	20	37	71	127
[illegible]	2	82	58	28	0	81	10	6	17	1	12	6	6	15	3	1	0	0	0	0	1	15	9	8	17	18
[illegible]	3	28	10	5	1	5	13	4	0	2	0	18	8	23	0	0	0	1	0	2	0	11	3	6	8	23
[illegible]	4	7	5	7	4	12	3	0	5	2	8	4	0	42	1	0	3	1	3	5	2	2	4	2	11	17
[illegible]	5	18	3	2	1	18	14	4	2	1	2	6	2	27	0	0	0	0	1	0	0	3	0	4	12	15
[illegible]	[illegible]	58	54	33	0	94	20	0	17	3	15	4	4	45	1	2	0	0	1	6	2	13	5	14	43	88
[illegible]	7	6	6	6	0	8	13	4	5	5	4	14	0	9	0	0	3	3	1	0	3	8	1	3	5	16
[illegible]	[illegible]	1	2	2	0	2	2	1	1	1	0	1	0	5	0	0	1	1	0	1	0	3	0	1	1	9
[illegible]	[illegible]	0	1	0	0	3	0	0	0	1	0	0	0	2	0	0	0	3	0	0	0	2	0	1	0	1
[illegible]	10	12	5	11	0	20	11	1	3	3	3	2	1	25	2	1	0	1	2	0	1	5	3	8	15	31
[illegible]	11	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[illegible]	12	0	0	2	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0
[illegible]	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1
[illegible]	14	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
[illegible]	15	0	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
[illegible]	16	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	17	0	0	0	0	0	0	0	11	0	1	0	0	2	0	0	0	1	0	0	0	1	0	7	0	0
[illegible]	18	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
[illegible]	21	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
[illegible]	22	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
[illegible]	24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
[illegible]	30	0	0	0	0	0	1	1	0	2	1	0	0	0	0	0	0	1	2	2	2	0	1	0	5	8
[illegible]	31	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
[illegible]	33	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	34	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
[illegible]	35	0	1	1	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	37	1	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	41	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0
[illegible]	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
[illegible]	44	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	51	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[illegible]	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	3	0	0	0	0	0	2	0	0	0	0	1	2	0	0	0	0	0	0	0	1	1	1	3	0	0

Appendix 2. Seasonal Data. 5/3/79.

Taxon		S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
CA	1	124	878	1880	484	2362	444	368	863	1038	302	327	1289	811	572	389	10	36	8	9	43	121	331	428	1086	239
CA	2	7	13	25	21	39	32	18	25	150	13	7	32	9	36	15	2	4	1	1	3	183	13	73	74	7
CA	3	78	88	208	48	108	47	44	61	48	29	12	80	10	5	27	0	10	3	2	11	120	12	14	55	15
CA	4	2	13	29	17	37	5	19	30	32	11	2	32	7	7	15	0	9	4	1	5	18	11	8	33	32
CA	5	27	19	85	13	48	14	3	82	20	16	18	11	8	23	13	2	0	0	0	0	398	3	39	17	15
CA	6	88	38	278	35	188	100	29	189	208	158	54	86	42	125	121	12	0	10	6	9	242	27	124	55	58
CA	7	0	0	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0
CA	8	3	5	15	4	12	3	1	2	23	4	0	9	0	0	0	0	2	0	0	48	23	0	0	5	18
CA	10	7	20	20	0	80	10	2	7	98	15	0	25	2	28	13	2	0	2	0	7	28	3	6	11	31
CA	11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	2	0	0	1	1
CA	12	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CA	13	2	0	24	1	11	5	0	2	0	2	0	0	0	0	0	0	0	1	0	0	42	1	0	2	3
CA	15	0	3	0	0	2	0	0	0	2	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0
CA	17	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	20	3	0	21	4	8	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	25	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	32	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	33	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	43	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
CC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0
CC	2	5	8	27	1	9	2	4	14	9	2	12	9	6	10	5	0	0	0	0	1	3	1	2	0	1
CC	4	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	4	3	12	0	0	17	0	8	12	8	2	0	1	2	0	0	0	0	0	0	38	0	2	0	0
CT	2	0	0	0	0	7	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	5	3	3
CT	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
CT	5	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MB	1	45	35	228	53	330	68	78	121	188	50	36	230	59	281	121	12	17	95	4	24	202	83	57	212	93
MB	2	21	23	218	14	108	104	18	95	72	60	117	48	48	33	33	8	0	2	0	0	276	13	83	27	12
MB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MB	4	5	6	26	9	15	2	1	1	8	0	12	4	6	4	3	0	0	0	0	0	11	0	1	8	2
MB	5	8	14	57	11	22	0	0	9	8	3	0	7	2	5	2	1	0	10	2	3	25	0	6	12	2
MB	6	0	0	8	1	7	1	11	5	12	3	6	10	4	29	3	0	0	1	0	0	8	5	4	21	11
MB	7	29	19	151	22	90	8	84	51	58	2	28	183	18	198	52	7	6	17	2	2	11	15	9	105	31
MB	8	2	14	27	11	84	95	25	72	141	54	10	53	12	81	29	0	0	6	0	0	160	17	105	23	13
MB	10	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
MB	11	0	0	2	0	1	0	1	0	2	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1
MB	13	0	0	4	0	0	0	0	0	1	0	0	0	0	3	2	0	0	0	1	0	0	0	0	7	1
MB	14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	15	1	0	0	0	1	1	0	1	0	0	1	5	2	0	1	0	0	1	0	1	1	1	0	7	1
MB	16	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MB	17	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	18	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	21	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	22	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	24	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MB	28	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MB	37	0	0	0	0	1	0	0	1	3	0	0	0	0	0	0	0	0	2	1	0	0	0	0	2	0
CA	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	1	2	1	8	14	7	0	2	1	0	0	5	5	3	6	5	1	1	0	0	0	3	0	4	10	3
CH	2	0	0	3	0	0	2	0	0	3	1	3	2	0	0	0	0	0	0	0	0	2	0	0	3	0
CH	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	4	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	11	13	4	21	0	14	13	1	5	1	0	0	3	1	6	4	0	2	4	0	1	49	0	1	2	1
CH	12	7	2	8	3	4	0	1	5	10	4	4	5	0	0	3	0	0	1	0	0	10	0	0	11	1
CH	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CH	14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	15	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
CH	16	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0
CH	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CH	21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0
CH	27	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
CH	37	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	41	0	1	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0
CU	1	14	40	63	13	104	8	18	12	16	2	39	66	14	31	10	2	5	1	3	3	36	1	10	43	3
CU	1	2	7	8	1	22	5	11	9	36	3	0	9	0	0	5	0	1	0	0	3	22	2	10	8	10
CU	2	0	3	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	2
CU	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	1	0	0	3	0	9	0	0	0	1	0	3	7	0	12	4	0	0	0	0	0	0	3	0	4	0
CD	2	1	3	10	0	11	5	3	3	5	1	5	5	2	1	1	0	1	0	0	0	0	0	3	0	0
CD	3	4	8	23	93	32	3	2	9	9	0	6	3	5	5	15	0	0	0	0	1	9	0	0	5	3

Cont.

Seasonal Data. 5/3/79 (Cont.).

Taxon		S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	1	3	1
[illegible]	[illegible]	0	0	12	0	7	0	0	1	0	0	0	0	1	0	4	0	0	0	0	0	0	0	1	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	2	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	4	0	0	1	0	0	0	2
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	2	0	2	0	0	0	3	0	0	1	0	1	0	0	2	1	0	0	0	2	0	1	1
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
[illegible]	[illegible]	0	0	2	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
[illegible]	[illegible]	30	47	249	28	100	98	28	159	38	42	55	34	27	59	46	17	3	43	0	3	307	21	82	39	44
[illegible]	[illegible]	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	47	56	79	35	119	21	22	48	53	29	13	52	29	70	47	5	3	13	4	16	61	20	11	61	39
[illegible]	[illegible]	19	13	37	17	74	21	4	9	7	3	14	9	2	13	5	0	3	9	2	0	101	2	9	2	1
[illegible]	[illegible]	9	8	35	12	12	3	3	10	2	5	7	10	9	6	3	0	1	8	0	0	48	1	7	4	3
[illegible]	[illegible]	1	2	7	4	3	2	2	2	3	0	0	7	2	9	2	1	1	0	0	2	2	3	0	12	3
[illegible]	[illegible]	1	5	1	2	7	2	0	3	1	1	9	8	5	0	11	0	0	0	0	0	9	1	0	0	2
[illegible]	[illegible]	1	8	34	12	35	9	8	4	21	20	3	30	3	32	5	0	2	5	0	2	53	2	17	21	4
[illegible]	[illegible]	3	9	20	2	2	4	2	9	1	5	0	10	3	20	3	1	1	16	0	1	30	4	2	9	5
[illegible]	[illegible]	0	1	0	0	5	0	1	1	2	0	0	3	0	5	0	0	1	0	0	1	0	0	0	3	0
[illegible]	[illegible]	1	0	2	0	0	1	0	2	0	0	0	0	0	0	1	1	0	1	0	0	11	1	1	0	3
[illegible]	[illegible]	1	0	5	7	25	3	2	1	5	1	0	7	0	38	0	3	0	6	0	2	40	0	7	9	0
[illegible]	[illegible]	1	1	9	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
[illegible]	[illegible]	1	1	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	2	1	0
[illegible]	[illegible]	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0
[illegible]	[illegible]	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	1	0	4	0	0	2	0	0	1	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	11	0	1	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	2	0	1	0	1
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	3	1	0	0	0
[illegible]	[illegible]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	2	0	1	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
[illegible]	[illegible]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[illegible]	[illegible]	1	0	0	0	0	1	0	0	0	1	0	1	0	3	0	1	0	1	0	1	0	0	0	0	0
[illegible]	[illegible]	2	0	0	0	3	0	0	0	0	0	0	0	1	2	0	0	1	1	0	0	1	0	0	2	0
[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Appendix 2. Seasonal Data. 5/4/79.

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
0A 1	109	135	110	575	154	204	174	225	552	257	821	181	70	55	300	5	8	3	24	7	257	132	307	389	551
0A 2	4	7	10	3	7	8	5	13	31	33	2	19	0	2	19	0	0	1	2	1	20	10	12	21	64
0A 3	35	80	54	99	28	23	4	16	75	35	11	28	4	5	15	10	2	1	4	5	25	21	28	70	132
0A 4	7	13	43	11	47	15	1	5	4	27	8	8	0	3	45	13	2	8	10	12	14	7	5	9	46
0A 5	8	15	15	32	4	15	14	8	174	43	4	22	2	3	8	0	0	0	1	3	24	7	20	40	69
0A 6	13	85	51	64	125	86	28	37	382	50	38	127	10	17	180	1	2	4	18	25	120	35	85	134	255
0A 8	2	13	7	1	4	1	0	2	7	1	0	0	1	0	0	7	0	0	8	2	4	2	0	15	8
0A 10	3	21	25	13	11	2	0	4	11	3	2	8	0	1	1	0	2	2	9	3	13	1	3	32	14
0A 11	0	1	0	0	1	0	0	3	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	6	3
0A 12	0	0	0	0	2	0	0	0	0	0	0	1	0	0	2	0	1	1	0	0	0	0	0	0	3
0A 13	1	0	0	0	0	1	1	0	7	0	0	1	0	0	0	0	0	0	0	0	1	0	5	11	1
0A 15	0	2	0	0	2	0	0	0	0	1	1	0	0	0	4	0	0	0	0	0	0	0	0	1	0
0A 20	11	2	0	2	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0A 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
0A 29	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0A 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0A 36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
0A 43	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0A 45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 1	0	0	0	1	0	1	0	0	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 2	0	3	0	1	0	0	0	0	0	1	4	3	3	1	0	0	0	0	0	1	1	2	2	1	1
0C 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	6
0C 7	0	1	2	2	2	0	1	0	91	7	0	1	1	0	0	0	0	0	0	0	4	4	1	5	38
0C 12	0	6	4	0	3	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	0	4
0C 14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0C 16	45	31	41	54	130	102	13	33	43	40	34	145	8	32	124	22	1	8	22	21	40	53	52	29	51
0C 2	37	17	20	57	12	19	14	21	181	52	17	48	4	13	13	0	0	1	11	4	26	11	28	63	43
0C 4	0	0	4	8	2	2	0	0	7	2	1	1	0	0	0	0	0	0	1	0	1	0	1	4	5
0C 5	11	18	14	22	16	5	0	2	4	0	0	0	0	0	0	2	0	0	0	0	7	2	1	10	3
0C 7	5	2	1	3	7	2	0	3	1	14	4	3	0	2	23	1	0	0	2	8	2	5	2	7	11
0C 8	12	5	18	7	80	34	5	15	1	20	13	45	1	31	81	16	2	9	13	0	13	9	12	4	35
0C 9	17	33	15	17	31	26	28	17	71	26	18	25	2	11	24	1	0	0	6	3	31	14	27	56	81
0C 10	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
0C 11	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1
0C 13	0	1	8	0	0	0	0	1	0	1	0	2	0	0	0	0	0	4	0	0	1	0	0	0	0
0C 14	0	2	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0
0C 15	0	0	1	3	2	1	0	1	3	1	0	2	0	1	1	0	1	0	0	0	0	1	3	0	7
0C 16	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0C 21	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 24	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0C 28	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0C 34	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 37	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 43	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 44	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
0C 46	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0C 48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0E 4	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0E 1	0	0	8	5	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3	0	1	9	9
0E 2	0	0	9	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
0E 3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0E 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0E 11	1	8	0	8	2	0	0	0	1	1	1	0	1	1	3	1	0	0	2	2	2	1	1	3	7
0E 12	0	3	3	3	0	3	0	3	4	6	1	0	0	0	0	1	0	0	0	1	2	0	0	3	3
0E 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1
0E 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0E 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
0E 27	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0E 1	13	5	5	13	11	4	2	1	13	6	0	25	2	0	9	1	0	0	0	0	3	0	0	1	13
0E 1	5	8	5	5	10	9	1	2	13	24	4	4	2	0	12	3	0	0	3	2	6	3	1	18	24
0E 2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
0E 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0E 9	2	0	0	0	1	0	0	0	0	1	0	2	1	0	1	0	0	0	0	0	0	0	0	0	1
0E 2	1	0	1	2	0	5	1	1	20	2	0	2	0	0	0	0	0	0	0	0	1	0	2	2	2
0E 3	3	2	4	19	1	1	5	3	15	0	4	13	0	0	1	1	0	0	0	0	7	0	4	3	5
0E 4	1	2	0	2	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
0E 8	2	0	2	1	5	2	0	1	3	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	5
0P 1	2	1	4	4	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1
0P 2	0	0	3	5	0	1	0	1	0	1	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0

Cont.

Seasonal Data. 5/4/79 (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
SA	1	0	3	0	3	1	0	0	1	0	0	0	0	0	0	2	1	3	0	4	1	0	0	0	2
SB	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	1	0	0	2
SC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
SD	0	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
SE	1	1	0	0	4	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	0	2
SF	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
SG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
SH	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SJ	0	2	4	17	15	7	2	4	15	10	12	19	5	0	28	24	6	3	7	27	5	13	15	8	22
AP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CX	0	0	0	0	16	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0
XP	36	44	41	45	21	35	9	22	33	39	9	15	5	10	13	9	2	13	10	11	29	22	31	21	44
XP	2	28	7	20	28	15	11	13	7	15	7	26	24	10	1	12	3	0	1	5	3	20	14	22	11	28
XP	3	4	4	9	25	1	5	11	2	4	9	4	10	6	7	4	2	0	0	1	3	8	2	15	6	11
XP	4	29	20	43	14	132	17	1	9	3	50	18	38	1	2	112	9	5	14	13	18	21	6	2	10	93
XP	5	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	0
XP	6	8	7	5	23	32	16	9	10	76	19	6	7	11	2	13	8	2	1	3	5	37	28	29	36	65
XP	7	10	14	8	11	6	10	5	1	17	13	7	7	2	3	4	10	0	2	2	3	5	10	10	20	22
XP	8	0	3	2	0	2	1	0	0	1	0	1	2	0	1	3	0	0	0	1	1	1	1	0	2	7
XP	9	0	0	1	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	0	0	1
XP	10	7	3	3	6	24	2	1	0	5	12	2	12	4	0	9	3	0	0	4	4	14	2	8	6	31
XP	11	0	3	1	0	4	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0
XP	12	0	3	2	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0
XP	13	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	2	3	0	1	1	1	2
XP	14	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
XP	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1
XP	16	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
XP	17	0	0	1	0	0	1	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1
XP	18	0	0	0	0	1	0	0	0	1	1	0	0	1	0	2	0	1	0	0	1	0	2	1	1	4
XP	20	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
XP	22	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
XP	24	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
XP	26	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	1
XP	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
XP	30	2	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	2	1	0	0	0	0
XP	33	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
XP	34	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
XP	35	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	2	0
XP	36	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
XN	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
XN	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
XN	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
XN	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
XN	6	0	0	3	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	0	0	1	0	0
XO	2	0	2	0	0	1	0	3	0	0	5	1	1	1	0	10	2	1	0	0	2	0	0	1	0	1
XO	3	0	0	0	0	1	2	0	1	0	0	0	3	0	0	1	0	0	0	3	2	4	4	0	2	3
XO	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0

Appendix 2. Seasonal Data. 3/5/79.

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
0A	1	120	12	72	82	20	188	88	284	388	58	418	1	227	22	95	15	10	38	5	6	308	81	34	448	41
0B	2	7	2	8	4	1	15	12	8	75	5	81	0	27	5	8	3	2	12	0	1	32	15	4	44	5
0C	3	20	13	40	46	18	69	17	8	45	17	158	0	53	3	24	23	7	18	4	8	91	14	9	70	11
0D	4	0	0	0	0	0	52	0	2	1	1	53	0	0	0	0	12	5	3	1	0	18	8	0	25	7
0E	5	22	19	21	33	12	20	38	82	47	78	38	2	42	7	127	1	0	3	0	0	97	82	30	71	31
0F	6	22	7	14	27	24	85	45	188	218	154	115	2	55	18	97	18	15	24	0	0	155	85	7	188	48
0G	7	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	28	7	0	1
0H	8	11	0	0	2	0	22	0	0	0	0	0	0	0	0	0	3	5	1	0	0	8	0	1	1	0
0I	10	1	0	0	0	0	1	2	0	0	0	1	0	0	3	0	4	5	1	0	0	1	12	1	6	0
0J	11	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0
0K	13	0	0	0	2	0	2	1	2	4	5	2	0	0	1	1	0	0	0	0	0	5	2	0	1	0
0L	15	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0M	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0N	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0O	22	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0
0P	23	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0Q	25	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0R	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0S	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0T	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
0U	1	0	0	0	2	0	0	0	0	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
0V	2	1	0	0	5	1	1	2	0	0	0	4	1	7	0	3	0	0	0	0	0	1	4	2	1	1
0W	2	15	6	2	0	2	5	8	22	128	159	3	0	2	4	10	0	3	1	0	1	7	31	2	29	2
0X	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	2	38	2	10	9	32	57	6	9	19	2	127	0	44	7	4	12	12	15	1	1	42	11	4	17	4
MG	2	11	1	7	10	32	18	98	23	145	67	51	3	27	14	27	3	3	6	0	0	39	18	2	18	20
MG	4	3	1	2	1	2	1	1	5	5	5	3	0	7	0	1	0	0	0	0	0	2	0	0	1	2
MG	5	17	0	7	12	5	1	1	0	4	0	11	0	5	0	1	0	3	0	1	3	0	9	0	3	2
MG	6	0	0	0	0	0	2	0	0	2	0	7	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MG	7	0	0	1	0	2	11	0	0	10	1	21	0	0	0	0	16	2	3	0	0	5	0	2	1	4
MG	8	9	0	4	8	5	18	10	37	78	42	20	2	18	5	2	1	0	0	0	0	38	10	2	24	8
MG	10	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
MG	11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MG	13	0	0	0	0	0	1	0	0	0	0	3	0	4	0	0	1	0	0	0	0	0	2	0	1	0
MG	15	2	3	1	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	0	2	0	0	1	1
MG	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MG	17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	28	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MG	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CC	2	5	0	0	1	0	0	0	0	1	0	3	0	4	4	2	0	0	0	0	0	0	0	0	0	0
CC	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CC	11	5	3	2	5	3	5	2	0	2	0	9	1	8	0	1	2	0	1	0	0	7	4	1	4	2
CC	12	3	0	0	1	2	3	0	0	0	2	5	0	5	1	0	0	1	0	0	0	6	1	0	6	4
CC	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
CC	16	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	31	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	41	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5
CC	1	6	0	3	5	1	1	1	0	1	0	5	0	3	0	3	0	0	1	0	0	1	1	0	1	3
CC	5	5	0	2	2	0	19	1	0	7	0	13	0	11	0	1	0	1	0	0	0	5	2	1	11	5
CC	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CC	2	1	0	1	1	0	4	1	1	5	8	2	0	0	0	0	0	1	0	1	0	0	0	0	2	4
CC	3	2	1	0	4	0	2	4	2	7	1	23	0	4	0	3	0	0	0	0	0	2	0	1	4	2
CC	2	0	0	0	0	0	1	2	0	0	2	3	0	2	0	1	1	0	0	0	0	0	1	0	0	1
CC	1	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	2	1
CC	2	1	0	0	1	0	1	0	0	0	0	15	0	1	0	0	1	1	0	0	0	0	0	0	0	0
SA	1	1	1	1	0	1	0	0	0	0	0	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0
SA	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
SA	2	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0
SA	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
SA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	2
SA	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
SA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	1	0
VI	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI	1	4	4	2	10	4	10	10	18	15	10	153	0	31	36	16	18	62	38	1	2	86	25	6	42	27

Cont.

Seasonal Data. 3/5/79 (Cont.).

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	33	4	8	15	27	42	21	16	25	21	42	1	19	18	36	19	15	15	1	1	56	20	13	38	25
4	73	5	24	27	11	4	2	8	6	5	34	0	28	11	23	4	1	0	2	1	12	4	7	8	13
5	1	1	1	7	4	2	2	1	3	3	12	0	9	8	10	3	3	2	0	0	23	29	14	33	6
6	2	1	1	3	8	5	21	0	2	3	6	45	1	7	2	3	14	7	6	0	1	15	6	1	15	2
7	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	0	0	1	0	0	2	0	1	1	2
8	26	2	5	22	2	8	12	2	28	35	92	2	27	28	15	7	8	4	1	0	52	19	12	36	32
9	14	4	7	15	8	17	10	5	8	2	24	0	28	17	13	12	12	17	1	5	40	14	8	37	20
10	0	0	0	0	0	0	0	0	0	0	2	0	2	1	1	1	2	1	0	0	1	2	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	2	1	0	0	0
12	8	1	0	2	2	3	2	5	7	8	12	0	8	8	2	0	3	3	0	0	14	7	2	13	4
13	3	1	0	3	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0
15	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	5	1	0	0	3	0	0	0	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
17	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0
18	1	0	0	0	0	0	0	2	2	0	2	0	1	0	1	0	2	0	0	0	2	1	0	3	0
19	0	0	0	0	0	1	0	0	0	0	5	0	0	1	1	0	0	3	0	0	30	3	0	3	1
20	2	0	0	0	0	2	0	0	3	0	0	0	0	1	0	0	3	4	0	0	1	1	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
24	0	0	0	0	0	2	0	3	3	0	0	0	0	1	0	0	10	0	0	0	1	1	0	1	0
28	0	0	1	0	0	0	0	0	0	0	4	0	3	0	0	0	0	0	0	0	1	1	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
35	0	0	0	0	0	0	0	0	1	0	4	0	1	0	0	0	1	1	0	0	1	0	0	0	0
38	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0
40	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
1	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0
3	0	0	0	1	2	1	1	0	0	0	5	0	0	0	1	1	3	0	0	0	2	5	1	1	0
4	7	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix 2. Seasonal Data. 4/6/79.

Taxon	S.bracteolosum					S.verruculosum					Cystophora					Zonaria					Caulocystis				
CA		43	42	18	15	9	41	128	59	182	77	239	24	1	12	18	1	3	0	1	0	112	355	97	240	134
CA	2	3	2	1	2	1	12	24	3	17	5	12	2	0	3	1	0	0	0	0	0	8	32	8	15	3
CA		49	27	22	23	11	14	17	21	99	28	98	13	0	8	3	0	25	1	1	1	30	59	30	45	19
CA		2	0	0	0	19	2	2	1	19	7	7	0	0	4	8	0	2	4	0	6	9	8	1	11	15
CA	5	30	23	6	25	3	95	91	38	79	90	146	35	1	7	7	0	3	0	0	1	42	174	41	40	33
CA		24	9	12	20	18	93	104	45	160	136	76	29	0	7	20	2	5	0	3	3	91	211	123	85	68
CA			0	0	0	0	0	2	0	0	0	1	1	0	0	0	0	0	0	0	0	2	4	0	2	1
CA		2	2	1	1	4	2	3	1	5	0	7	0	0	0	0	0	15	0	0	0	3	5	1	27	3
CA		2	0	2	1	2	1	2	0	2	99	6	1	0	0	7	0	0	0	0	4	1	18	3	6	6
CA		0	0	0	1	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0
CA		0	1	0	1	0	5	1	2	3	1	4	0	0	0	0	0	0	0	0	0	0	10	2	2	1
CA		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
CA	17	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	20	2	0	1	4	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	21	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CC		1	0	2	0	0	5	4	0	0	3	0	0	3	0	0	0	0	0	0	0	4	0	0	0	0
CC	4	3	0	0	0	0	0	2	0	0	0	9	0	0	0	0	0	0	0	0	0	0	5	0	0	0
CC		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
CC		2	57	1	2	0	161	94	20	18	77	16	20	0	0	0	0	2	0	0	0	18	21	16	13	4
CC	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CC	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC		9	7	8	17	31	15	7	14	77	10	90	3	0	25	133	1	0	3	8	1	3	28	16	49	29
CC	2	15	8	10	26	0	58	20	11	84	30	20	24	1	21	12	0	0	0	0	0	20	32	14	96	22
CC	4	0	0	0	3	0	4	0	1	2	2	1	2	0	2	0	0	0	0	0	0	1	3	5	3	1
CC	5	22	8	10	4	0	5	5	0	16	5	4	6	0	2	1	0	0	0	0	0	0	11	4	0	0
CC	6	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1
CC	7	1	0	1	0	34	0	0	0	19	0	8	0	1	31	1	1	2	1	8	6	0	0	1	0	29
CC	8	4	0	1	0	2	24	12	8	12	27	11	15	1	10	27	0	0	0	0	1	14	27	16	13	9
CC	10	0	0	0	0	0	1	0	0	0	0	2	0	0	1	6	0	0	0	1	0	0	0	0	0	1
CC	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	13	0	1	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CC	14	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	15	0	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CC	16	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	17	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CC	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CC	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CC	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CC	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
CC	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CC	1	0	0	4	2	0	0	1	0	0	0	4	2	0	0	0	0	0	0	0	0	0	1	0	0	0
CC	2	0	0	0	0	1	1	1	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CC	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	11	11	3	6	3	7	5	5	2	18	14	18	4	0	3	5	0	1	0	1	1	3	21	5	9	9
CC	12	0	0	0	2	3	0	1	1	8	2	3	0	0	1	1	0	0	0	0	0	2	1	2	0	2
CC	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CC	16	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CC	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CC	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
CC		0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0
CC		3	0	1	4	5	3	1	2	12	6	3	1	0	3	5	0	0	0	0	0	9	4	1	8	3
CC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	1	0	0	0	2	0	0	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CC	2	0	0	0	0	0	2	3	0	2	4	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
CC	3	1	0	0	0	0	0	3	0	5	2	1	0	0	1	0	0	0	0	0	0	1	1	1	1	0
CC	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	1	0
CC	2	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0
CC	2	2	0	0	2	3	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	2	4	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CC	1	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	2	1	0	1	0
CC	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
CC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0
PL	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AT	1	11	1	2	0	3	5	9	3	15	11	26	5	1	4	8	1	3	25	7	12	4	68	1	26	30
TA	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	1	44	13	7	21	6	39	34	14	57	42	130	21	2	4	16	1	3	1	6	1	16	111	21	68	24
WP	2	32	19	7	13	2	6	2	8	20	10	86	10	1	3	18	0	1	0	0	0	8	25	10	8	20

Cont.

Seasonal Data. 4/6/79 (Cont.).

Taxon	S.bracteolosum	S.verruculosum	Cystophora	Zonaria	Caulocystis

APPENDIX 3: FANCY POINT SPATIAL DATA

The abundances of phytal animal taxa (rows) associated with each plant (columns) collected during the spatial sampling program. The majority of abbreviations for animal taxa were given at the start of the previous appendix. Additional abbreviations are as follows:

CA 102: Hyale ?loorea, CA 104: Hyale kandari, CA 105: Podocerus sp.1,
CA 107: Stenothoe sp., CA 108: Gitanopsis sp.1, CA 109: Podocerus sp.2,
CA 110: Amphilochidae A, CA 111: Paradexamine sp.1, CA 112: Tethygeneia sp.2,
CA 114: Cymadusa sp.3, CA 115: Syndexamine sp.1, CA 116: Calliopidae A,
CA 117: Paradexamine sp.2, CA 118: Eusiridae A, CA 119: Raumahara judithae,
CA 120: Gitanopsis sp.2, CA 121: Mesoproboloides cruxlorraina,
CA 123: Aora maculata, CA 124: Panoplea sp.1, CA 125: Tethygeneia sp.3,
CA 126: Ausatelson ule, CA 127: Quasimodia sp., CA 128: Lembos sp.2,
CA 129: Eusiridae B, CA 130: Gammaridae B, CA 132: Lyssianassidae A,
CA 133: Stenothoidae A, CA 134: Syndexamine sp.2, CA 135: Gammaropsis sp.,
CA 137: Leucothoe sp.2, CA 139: Lyssianassidae B, CA 140: Tethygeneia sp.4,
CA 141: Corophium sp.2, CA 142: Stenothoidae B, CA 143: Lyssianassidae C,
CA 144: Aora sp.2, CA 147: Amphilochidae B, CA 149: Corophidae B,
CA 150: Pontogeneidae A, CA 151: Phoxocephalidae B, CA 152: Lyssianassidae D,
CA 154: Paradexamine sp.3, CA 155: Phoxocephalidae C, CA 157: Aora sp.3,
CA 159: Podocerus sp.3, CA 160: Gammaridae B, CA 161: Colomastix sp.2,
CA 163: Leucothoe sp.2, CA 164: Ampithoe sp.4,
CC 101: Proto sp., CC 104: Caprella sp.2,
CT 101: Tanaid B,
CI 5: Amphoroidea angustata, CI 22: Asellote C, CI 24: Neastacilla sp.,
CI 25: Panathura sp.,
CD 4: Hyppolyte sp.,
CB 4: Nectocarcinus tuberculosus (M.Edwards),
CZ 1: Zoea larva,
PL 11: Turbellarian C, PL 12: Turbellarian D,
VI 10: Alabes parvulus, VI 11: Ichthyes A,
AP 4: Ammothea sp.,
MG 101: Dentimitrella sp.2, MG 102: Microdiscula charopa Tate,
MG 103: Dentimitrella sp.3, MG 105: Doriopsilla peculiaris,
MG 106: Rissoella ?micra Finlay, MG 107: Herpetopoma sp.,

MG 108: Aeolidae A, MG 109: Pisinna megastoma Ponder & Yoo,
WP 101: Syllidae M, WP 106: Syllidae N, WP 107: Autolytus sp.2,
WP 112: Syllidae P, WP 113: Typosyllis sp.2, WP 114: Mystides sp.,
WP 115: Nereis ?thompsoni Kott, WP 116: Odontosyllis sp.,
WP 117: Autolytus sp.4, WP 118: Syllidae Q, WP 119: Syllidae R,
WP 120: Syllidae S, WP 121: Syllidae T,
WN 11: Nemertean D, WN 12: Nemertean E, WN 13: Nemertean F,
WN 14: Nemertean G, WN 15: Nemertean H, WN 16: Nemertean I.

Appendix 3. Spatial Data

Taxon	Acrocarpia					Thamnoclonium					Ulva					Cladophora					Hormosira				
CA 1	8	4	27	35	46	5	2	0	0	1	0	0	0	0	1	0	0	0	0	24	0	0	0	0	0
CA 2	24	18	86	87	29	15	9	1	8	15	0	0	0	0	0	0	2	8	1	1	0	0	0	0	0
CA 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 4	0	0	0	0	0	5	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 6	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0
CA 7	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 8	0	0	5	2	1	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 11	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 13	2	32	25	75	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 20	2	1	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 21	15	4	10	13	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0
CA 23	0	0	0	0	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 25	2	1	8	1	4	0	0	0	0	0	0	1	2	0	2	0	0	0	0	4	0	0	0	0	0
CA 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 32	0	0	0	0	0	2	0	4	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 43	2	0	15	8	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 102	184	0	104	3	196	0	0	0	0	0	0	0	0	0	2	3	20	1	1	10	0	0	8	0	2
CA 104	7	0	5	3	22	0	0	0	0	0	15	0	13	38	5	2	0	4	0	5	35	4	0	8	2
CA 105	765	72	145	308	250	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
CA 107	2	0	10	0	271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	5
CA 108	4	2	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
CA 109	52	3	5	31	36	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA 110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 111	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 112	234	7	150	16	201	0	0	0	0	0	0	0	0	0	0	1	13	2	4	0	0	0	0	1	0
CA 114	0	0	0	0	0	2	4	0	3	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 115	0	0	6	43	2	0	0	0	0	0	0	0	0	0	0	0	6	4	6	0	0	0	1	0	0
CA 116	1	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 117	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 118	20	2	55	3	55	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 119	4	1	2	8	4	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2	0	3
CA 120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 121	784	37	245	62	459	0	0	0	0	0	0	0	0	0	0	0	8	2	1	0	0	0	0	0	0
CA 123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 124	149	10	22	12	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 125	9	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
CA 126	13	0	3	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 127	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 128	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 129	0	0	0	0	0	0	0	0	0	0	13	0	2	2	0	0	0	0	0	0	73	0	0	0	4
CA 130	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 132	0	0	0	1	0	1	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CA 134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 135	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	2	0
CA 137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 139	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 140	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 141	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA 142	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA 143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 155	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 157	1	1	0	4	0	2	16	6	18	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CA 159	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 161	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 164	18	3	28	25	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 4	928	109	904	211	1208	0	0	0	0	0	0	0	0	0	0	2	20	31	33	0	0	1	0	0	8
CC 101	2	0	6	1	14	0	0	0	0	0	0	0	0	0	0	1	24	21	18	4	0	0	0	0	0
CC 104	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 1	8	0	49	5	36	5	0	2	11	5	0	0	0	0	0	0	0	0	0	0	2	1	1	3	3
CT 2	4	0	3	0	8	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Acrocarpia					Thamnoclonium					Ulva					Cladophora					Hormosira				
CY 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 1	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 2	3	1	2	11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	3	6
CY 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CY 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 5	1	2	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 6	17	3	18	30	43	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CY 11	0	0	0	0	0	8	13	0	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 12	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
CY 13	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CY 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 15	0	0	0	1	0	1	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 16	0	0	0	0	0	3	0	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 18	0	0	0	0	0	13	11	27	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 19	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 26	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 27	5	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 31	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 41	0	1	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CM 1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CU 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CU 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 2	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TA 1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 11	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0
PL 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
VI 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 10	0	0	2	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 2	57	3	40	19	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
AP 4	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD 1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE 1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 1	1	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
SA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI 1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 2	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MG 3	0	0	0	0	1	0	0	1	4	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0
MG 4	0	0	0	0	2	1	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
MG 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 7	4	0	0	1	2	2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Acrocarpia					Thamnoclonium					Ulva					Cladophora					Hormosira				
MG 101	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 102	16	1	2	4	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MG 103	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 104	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 105	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 106	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 1	0	1	12	5	2	20	6	0	2	5	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0
MP 2	0	3	4	1	14	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0
MP 3	11	0	3	1	2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MP 4	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 5	42	2	34	17	99	0	0	0	0	0	0	0	0	0	0	0	1	2	5	41	0	0	0	0	1
MP 6	1	0	0	0	0	10	7	0	5	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1
MP 7	5	0	12	3	8	5	8	4	27	5	0	0	0	0	2	4	0	1	0	0	0	0	0	0	0
MP 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 9	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 10	1	1	3	5	1	5	11	3	6	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MP 11	22	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 13	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 14	3	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MP 15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 16	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 17	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 18	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	3
MP 24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MP 29	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 35	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 56	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MP 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 109	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 113	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MP 116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 120	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 11	0	1	7	5	4	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MN 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
MN 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 15	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3. Fancy Point Spatial Data.

Taxon	Anotrichium					Cystophora torulosa					Sargassum bracteolosum					Seirococcus					Sargassum verruculosum				
CA 1	0	24	11	0	9	5	3	1	9	0	15	9	5	1	3	8	4	52	8	50	4	1	2	0	3
CA 2	6	22	4	3	2	0	0	0	0	0	19	25	2	0	1	11	1	85	61	60	0	0	0	0	5
CA 3	0	0	0	0	0	0	0	0	0	0	0	12	0	0	3	0	0	0	10	0	0	0	0	0	0
CA 4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CA 5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
CA 6	0	0	0	0	0	0	0	0	3	0	0	8	1	0	10	0	0	0	0	0	0	0	4	0	5
CA 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
CA 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 11	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 13	0	0	0	0	0	0	2	1	7	0	17	7	21	18	0	0	0	0	0	0	25	0	5	0	3
CA 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CA 20	0	0	0	0	0	6	15	24	8	3	2	0	3	23	0	0	0	0	0	0	0	0	0	0	0
CA 21	0	0	0	0	0	0	2	0	0	2	2	0	4	1	0	15	4	42	3	18	0	0	0	0	0
CA 23	0	0	0	0	0	0	0	0	0	0	3	1	0	2	1	0	0	5	2	6	0	0	0	6	0
CA 25	0	0	0	0	0	0	1	0	1	0	20	7	5	0	0	0	0	5	7	19	12	0	0	0	0
CA 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0
CA 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
CA 43	0	0	0	0	0	0	0	0	0	0	19	0	5	0	0	3	0	58	28	12	0	0	0	0	0
CA 102	0	0	0	0	0	17	595	11	242	25	62	0	18	5	0	0	8	31	0	38	68	1	11	0	0
CA 104	0	0	0	2	0	11	21	19	147	117	9	1	3	28	0	0	0	22	0	2	5	0	0	0	0
CA 105	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	12	1	84	0	33	0	1	0	0	0
CA 107	0	0	0	0	0	0	1	1	0	0	8	0	11	4	0	0	2	0	0	0	0	0	0	0	0
CA 108	0	0	0	0	0	0	0	0	0	5	3	0	0	0	0	4	1	8	0	2	0	0	1	0	0
CA 109	0	0	0	0	0	0	0	0	0	0	3	0	2	0	0	13	2	24	10	9	0	0	0	0	0
CA 110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 111	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 112	1	0	0	0	0	0	52	7	12	30	13	0	8	0	0	8	1	62	3	108	2	1	0	0	0
CA 114	0	2	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	0	0	0	5	2	0	0	0
CA 115	0	0	0	0	0	0	0	0	3	0	1	0	8	0	0	0	0	0	0	1	11	0	0	0	0
CA 116	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	29	15	76	454	46	0	0	0	0	0
CA 117	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 118	0	0	0	0	0	0	1	0	11	4	10	0	19	0	0	1	2	4	1	5	6	0	0	0	0
CA 119	0	0	0	0	0	0	2	7	12	5	3	1	0	5	0	8	6	44	15	49	0	0	0	0	0
CA 120	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 121	0	0	0	0	0	0	0	0	8	1	1	1	0	0	0	22	9	85	0	76	3	0	3	0	0
CA 123	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	6	5	13	0	0	0	0	0
CA 125	0	0	0	0	0	4	31	0	27	1	0	0	2	7	0	1	1	0	0	5	0	0	0	0	0
CA 126	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	2	3	0	3	0	0	0	0	0
CA 127	0	0	0	0	0	9	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
CA 129	0	0	0	0	0	3	2	3	1	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0
CA 130	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 132	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CA 134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CA 135	0	0	0	0	0	2	0	10	0	58	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0
CA 137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 140	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	0	0	0	0	0	0
CA 141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 157	0	0	0	0	0	0	0	0	0	0	0	0	3	7	0	0	0	0	0	0	0	0	0	0	0
CA 159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 164	0	0	0	0	0	3	11	10	21	13	6	0	19	8	0	0	1	4	0	4	4	0	0	0	0
CC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CC 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 4	0	0	0	1	0	0	196	2	203	12	12	2	0	80	2	19	26	96	0	506	10	13	5	0	0
CC 101	4	1	0	8	0	0	7	0	4	0	8	0	0	0	0	4	3	29	0	8	0	9	0	0	0
CC 104	0	1	0	0	0	0	0	1	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon		Anotrichium					C.torulosa					S.bracteolosum					Seirococcus					S.verruculosum				
CT	1	0	0	0	0	0	26	10	14	20	25	12	1	10	24	6	4	0	13	2	3	4	0	2	0	5
CT	2	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
CT	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	1	0	0	0	0	0	0	0	0	0	0	0	10	0	0	2	0	0	0	0	0	0	0	0	0	1
CI	2	0	0	0	0	0	0	6	0	3	1	13	1	2	5	0	0	0	0	0	0	0	1	0	0	0
CI	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CI	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	1	0
CI	5	0	0	0	0	0	0	1	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	1
CI	6	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	2	0	2	0	1	0	0	1	0	0
CI	11	0	1	0	0	0	0	0	1	0	6	0	0	0	29	0	0	0	0	3	0	1	0	1	0	0
CI	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0
CI	14	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI	27	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
CI	31	0	0	0	0	0	1	1	0	1	0	1	0	1	0	0	1	0	2	1	3	1	0	0	0	0
CI	41	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	0	0	0	0	0
CM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CU	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CU	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
CB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
CB	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
SA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TA	1	0	0	0	0	0	0	0	0	2	0	1	0	0	1	0	1	0	2	0	1	0	0	0	0	0
PL	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
PL	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL	11	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
PL	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP	2	0	0	0	0	0	0	0	0	1	0	0	0	3	1	0	1	0	3	1	2	0	0	0	0	0
AP	3	0	0	0	0	0	1	0	0	2	1	1	0	8	3	0	0	0	2	0	0	0	0	1	0	0
AP	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EO	1	0	0	0	0	0	0	1	2	1	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
EE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0
EA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	2	0	0	3	0	0	0	5	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
MG	3	0	0	0	0	0	1	0	12	3	3	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0
MG	4	1	1	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	3	4	0	0	0	0	0	0
MG	5	0	0	0	0	0	0	0	0	0	0	0	1	1	0	8	2	0	9	2	0	0	0	0	0	1
MG	7	1	1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	4	1	0	0	0	0	0	0
MG	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Anotrichium					C.torulosa					S.bracteolosum					Seirococcus					S.verruculosum				
MG 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 101	0	0	0	0	0	0	0	0	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
MG 102	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	5	0	13	0	0	0	0	0	0	0
MG 103	0	0	0	0	0	0	0	5	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 104	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG 105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 106	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 1	0	3	0	0	1	0	1	0	1	0	10	21	0	1	5	5	0	16	10	8	0	0	5	0	1
WP 2	0	1	0	0	0	1	12	11	3	6	12	17	6	0	12	16	3	22	4	16	1	0	2	0	0
WP 3	2	0	0	0	0	0	10	1	15	2	0	1	0	1	0	0	0	4	0	3	0	0	0	0	0
WP 4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 5	0	3	1	6	0	3	131	2	142	3	10	3	6	0	0	0	1	15	0	59	0	1	3	0	1
WP 6	0	0	0	2	0	0	0	0	1	1	0	1	0	0	3	0	0	0	2	0	0	0	0	0	1
WP 7	0	0	0	0	0	1	24	7	15	11	0	5	0	6	11	6	0	11	8	5	0	0	0	0	1
WP 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 9	0	0	0	0	0	0	1	5	1	2	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0
WP 10	1	0	1	0	0	0	1	0	0	1	1	5	1	0	8	0	0	0	3	0	0	0	1	0	4
WP 11	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 13	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 14	1	0	0	1	0	0	0	0	5	1	0	0	0	1	0	3	0	3	0	0	0	0	0	0	0
WP 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 16	0	0	2	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	2	0	0	0	0	0	1
WP 17	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	2	0	1	0	2	1	0	0	0	0
WP 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 20	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
WP 21	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
WP 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 31	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
WP 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 53	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
WP 106	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
WP 107	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 108	0	0	0	0	0	0	2	5	1	11	0	0	0	1	0	2	0	0	0	2	0	0	0	0	0
WP 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 112	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 113	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
WP 114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 116	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WO 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WO 2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WO 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
WN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 11	0	0	0	0	0	0	0	0	0	0	3	0	2	0	0	5	0	4	2	2	0	0	0	0	0
WN 12	0	0	0	0	0	0	2	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 13	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3. Fancy Point Spatial Data.

Taxon	Caulerpa trifaria					Sargassum decipiens					Cystophora moniliformis					Plocamium					Phacellocarpus				
CA 1	0	1	2	7	0	24	59	3	1	35	7	15	6	19	2	0	3	0	10	2	2	5	1	2	13
CA 2	0	0	1	9	1	2	26	1	1	43	1	1	5	12	0	0	0	0	20	1	7	1	3	4	0
CA 3	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 4	3	2	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 5	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
CA 6	0	0	0	2	1	4	15	5	7	17	0	0	9	29	5	0	0	0	0	0	0	0	0	0	0
CA 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 9	6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	4	2	0	0	0	0	3
CA 10	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 12	0	2	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 13	0	0	0	0	0	34	37	17	10	20	31	25	3	26	2	0	0	0	0	0	0	0	0	0	0
CA 15	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CA 20	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA 21	0	0	0	0	0	0	1	0	0	0	34	44	0	1	1	0	0	0	0	0	0	0	0	0	0
CA 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CA 25	0	0	1	1	0	36	9	0	2	18	10	7	6	32	1	0	0	0	2	1	0	0	0	2	3
CA 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 43	0	0	0	0	0	2	10	0	1	9	6	13	4	35	2	1	0	0	0	0	4	0	0	0	0
CA 102	0	0	0	0	0	201	137	15	4	364	145	117	40	69	9	1	1	0	0	0	1	0	0	1	7
CA 104	0	0	0	0	0	72	119	8	7	43	40	15	7	35	3	2	3	2	2	3	0	4	1	1	68
CA 105	0	0	0	0	0	3	60	1	1	11	8	185	5	7	0	0	1	0	0	0	3	2	0	1	0
CA 107	0	0	0	0	0	0	8	0	0	0	7	14	0	3	0	1	0	0	0	0	0	0	0	0	0
CA 108	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CA 109	0	0	0	0	0	0	1	0	0	0	12	35	0	1	1	0	0	0	1	0	0	0	1	0	0
CA 110	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 111	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA 112	0	0	0	1	0	23	43	0	0	21	9	43	7	5	0	0	5	3	1	2	3	2	0	0	23
CA 114	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	6	0	0	0	0	0	0	0
CA 115	0	0	0	0	0	16	7	1	0	30	22	25	2	29	2	1	0	0	0	0	0	0	0	0	1
CA 116	0	0	0	0	0	0	0	0	0	0	19	9	0	0	0	0	1	0	0	0	14	33	16	0	7
CA 117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CA 118	0	0	0	0	0	7	25	0	0	19	5	10	1	3	1	0	0	0	1	2	2	4	0	0	2
CA 119	0	0	0	0	0	0	0	0	0	2	1	10	0	0	0	0	0	0	0	0	3	2	0	0	0
CA 120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 121	0	0	0	0	0	6	175	3	0	8	4	148	1	6	3	1	3	0	0	2	53	1	0	2	1
CA 123	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0
CA 124	0	0	0	0	0	0	17	0	0	1	0	0	0	0	0	0	1	0	0	1	9	14	0	1	5
CA 125	0	0	0	0	0	4	9	0	0	1	1	9	0	2	0	0	1	0	0	0	0	0	0	0	2
CA 126	0	0	0	0	0	0	12	0	0	2	0	0	0	0	0	4	4	1	4	4	5	31	8	0	7
CA 127	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
CA 128	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0
CA 129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 130	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	5	0	0	0	0	0
CA 132	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 133	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2	0	0	2
CA 134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA 137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CA 144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CA 149	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 150	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 151	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 164	0	0	0	0	0	10	22	0	0	27	46	10	0	9	0	1	1	4	0	2	0	1	0	3	0
CC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	22	0	0	0	0	0	0	0	0
CC 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 4	0	0	1	0	0	103	196	1	0	148	557	635	28	150	19	11	37	16	6	50	8	44	0	41	28
CC 101	0	0	2	0	0	12	69	8	0	28	1	2	0	0	0	14	0	5	6	27	28	45	13	4	51
CC 104	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	0
CT 1	0	0	0	0	0	14	22	5	2	81	45	24	12	45	5	0	0	0	0	0	0	0	0	0	0
CT 2	0	0	0	0	3	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1

Cont.

Spatial Data (Cont.).

Taxon	C.trifaria					S.decipiens					C.moniliformis					Plocamium					Phacellocarpus				
CT 3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 2	0	0	0	0	0	9	12	5	1	5	1	0	1	3	2	0	0	0	0	0	0	0	0	0	0
CI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 5	0	0	0	0	0	0	0	0	0	0	13	6	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	1	5	48	15	1	27	14	3	24
CI 11	1	0	1	2	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 13	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CI 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CI 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CI 18	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
CI 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 26	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CI 27	0	0	0	0	0	1	1	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 31	0	0	0	0	0	1	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0
CI 41	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	1	0	0	1
CM 1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CU 1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CU 2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
CD 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CB 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TA 1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
PL 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
AP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 2	0	0	0	0	0	1	4	0	0	0	2	1	0	1	0	0	1	0	0	1	0	3	1	1	0
AP 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EO 1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1
EE 1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
EA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	12
EA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI 1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	6	1	0	0	0	0	0	0	0	0
MG 1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6	1	0	0	0	0	0	0	0	0
MG 2	0	0	0	0	0	0	6	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0
MG 3	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
MG 4	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2	4	0	1	9
MG 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 7	0	3	1	0	3	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0
MG 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 10	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 11	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
MG 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	C.trifaria					S.decipiens					C.moniliformis					Plocamium					Phacellocarpus				
MG 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 50	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	1	0	0	0
MG 102	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	1	0	0	0	2	17	5	0	12
MG 103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 104	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 108	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 1	0	0	0	1	0	3	28	9	1	15	3	1	3	4	1	0	1	0	1	0	0	0	0	0	1
WP 2	0	0	0	0	0	9	1	6	2	14	4	8	1	6	1	0	0	0	0	0	0	1	0	0	0
WP 3	0	0	0	0	0	0	3	3	2	5	0	2	0	0	0	0	0	1	2	2	5	17	3	0	6
WP 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 5	0	0	0	0	0	5	13	1	2	91	2	25	2	5	0	0	2	0	0	2	0	4	0	1	2
WP 6	1	3	0	1	1	2	0	0	0	0	1	0	0	1	0	0	0	0	3	0	0	2	0	0	0
WP 7	0	3	1	2	8	4	1	0	1	19	0	5	0	7	3	0	0	2	4	1	1	0	0	0	0
WP 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 9	0	0	0	0	0	0	7	0	0	1	0	0	0	0	0	0	2	0	1	0	0	0	2	0	0
WP 10	0	1	0	1	3	0	0	0	0	2	0	0	1	1	0	0	1	0	1	0	3	0	0	0	0
WP 11	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
WP 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
WP 14	0	1	1	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 16	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 17	0	0	0	0	0	0	3	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0
WP 18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 31	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 42	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 51	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
WP 62	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 108	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
WP 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
WP 114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 120	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WP 121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
MO 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 3	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3	1	1	0	0	0
WN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 11	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WN 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3. Fancy Point Spatial Data.

Taxon		Ecklonia frond					Ecklonia holdfast					Zonaria turneriana					Zonaria sp.					Caulerpa trifaria				
CA	1	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0	10	2	1	1	0	1	0	2	0	2
CA	2	1	2	0	2	0	0	0	0	0	0	0	0	0	2	6	3	0	0	0	3	8	7	3	1	7
CA	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0
CA	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	5	11	1	2	4
CA	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
CA	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	9	0	0	0	0	0	53	2	6	87	9	3	5	0	6	0	3	0	0	0	0	9	0	0	0	1
CA	10	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0
CA	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	4	2	0	0
CA	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	3	3	3	0	1
CA	17	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	4	36	2	2	0	0	0	0	0
CA	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	23	0	0	0	0	0	1	0	0	1	0	1	4	2	0	0	24	2	3	5	5	0	0	0	0	0
CA	25	0	0	0	1	0	0	0	0	0	0	8	0	0	0	0	0	0	5	0	0	0	0	0	0	0
CA	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	43	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	102	0	0	0	1	0	0	0	0	0	0	2	0	3	0	0	0	4	1	0	0	0	0	0	0	0
CA	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
CA	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CA	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CA	108	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	1	0	2	0	0	0	0	0
CA	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
CA	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CA	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	112	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	1	0	3	3	1	0	0	0	2
CA	114	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	115	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	116	0	7	5	0	0	1	0	0	0	0	0	0	0	0	0	8	0	0	0	27	0	0	0	0	0
CA	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	118	0	0	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0	6	0	0	0	0	0
CA	119	0	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	1	2	0	0	0	0	0
CA	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	121	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	123	0	1	0	0	0	0	0	4	18	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CA	126	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	2	0	0	5	0	0	0	0	0
CA	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	128	0	0	0	0	0	20	4	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0
CA	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	130	0	0	0	0	0	8	0	5	29	1	5	0	0	0	0	0	9	0	0	0	0	0	0	0	0
CA	132	0	0	0	0	0	1	1	1	8	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA	133	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
CA	135	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
CA	137	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	147	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CA	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CA	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	163	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA	164	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	18	0	0	0	0	0	0	0	0
CC	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	4	0	1	1	2	0	0	0	1	0	0	2	0	0	1	0	1	10	0	10	5	0	1	0	0	0
CC	101	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	1	0	0	0	0	0	0	0
CC	104	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
CT	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Ecklonia frond					Ecklonia hold.					Z.turneriana					Zonaria sp.					C.trifaria				
CT 2	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0
CT 3	0	0	0	0	0	10	2	2	0	2	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
CT 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CT 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
CI 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0
CI 11	0	0	1	0	0	3	0	0	0	0	1	0	0	1	3	4	0	0	0	0	3	0	1	0	0
CI 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 13	0	0	0	0	0	2	0	5	22	2	3	4	8	0	0	0	0	0	0	0	0	0	0	0	0
CI 14	0	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0
CI 15	0	0	1	0	0	1	1	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 16	0	0	0	0	0	12	2	0	0	0	0	0	0	1	1	0	0	0	0	0	4	0	0	1	3
CI 18	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
CI 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0	0
CI 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 25	0	0	0	0	0	3	5	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 27	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0
CI 41	0	1	0	0	0	1	2	1	1	0	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0
CM 1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CU 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	2	0	0	0
CU 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CD 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0
CD 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CD 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CB 3	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
SA 2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TA 1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
PL 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 11	2	9	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
PL 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
VI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 3	0	8	2	1	0	2	0	0	0	0	4	2	0	0	0	0	3	0	0	0	0	0	0	1	0
AP 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
EH 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0
EH 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EO 1	0	0	0	0	0	0	0	3	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1	2
EE 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA 2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6	0	0	0	0	1	0	0	0
MG 4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
MG 5	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MG 7	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	15	0	0	0	0	22	8	6	1	3
MG 8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MG 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MG 13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MG 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 26	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Ecklonia frond					Ecklonia hold.					Z.turneriana					Zonaria sp.					C.trifaria				
MG 32	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 37	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 101	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	2	0	0	0	0	0
MG 102	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
MG 103	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 107	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA 4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 1	2	2	0	0	0	0	0	0	2	0	1	0	0	13	6	10	0	0	0	0	0	0	1	0	0
WP 2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	4	1	0	1	1	2	1	0	0
WP 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0
WP 4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	2	1
WP 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
WP 6	0	0	0	0	0	8	5	4	8	1	2	2	0	2	2	0	0	0	0	0	4	3	1	3	4
WP 7	1	1	0	0	0	25	22	6	11	2	2	0	0	1	7	0	3	0	0	0	0	2	1	2	0
WP 8	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WP 9	0	0	0	0	0	9	1	1	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 10	0	0	0	0	0	8	0	0	0	0	1	0	0	6	5	4	0	0	0	0	3	1	0	0	1
WP 11	0	0	0	0	0	2	1	1	0	1	0	0	0	1	0	0	3	0	0	1	0	0	0	0	0
WP 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
WP 13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
WP 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	0	0	0	0	0
WP 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 16	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
WP 17	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	3	0	0	0
WP 18	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
WP 20	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
WP 21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 29	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
WP 35	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
WP 39	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 53	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 62	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 101	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 108	0	0	0	0	1	5	2	0	2	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
WP 109	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 113	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
WP 114	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
WP 117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 118	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
WP 119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 121	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
WD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WD 2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WD 3	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	1	0	0	1
WN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 2	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
WN 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3. Fancy Point Spatial Data.

Taxon	Carpoglossum					Caulocystis					Hemineura					Cystophora retroflexa					Halopteris				
CA 1	3	1	0	7	2	29	15	17	25	37	1	4	5	1	2	2	6	6	5	236	0	4	0	42	7
CA 2	4	3	1	5	0	39	31	0	32	29	7	21	24	2	5	2	8	2	1	198	0	1	1	0	0
CA 3	0	0	1	3	0	0	4	0	5	9	0	2	3	0	0	1	0	1	0	63	0	0	0	0	0
CA 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0
CA 5	0	0	0	0	0	0	4	0	3	3	0	0	0	0	0	2	0	1	0	28	0	0	0	0	0
CA 6	0	0	0	0	0	19	14	6	21	55	0	0	0	0	0	1	3	11	4	168	0	0	0	0	0
CA 8	0	0	0	0	0	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	9	2
CA 9	1	0	0	2	0	0	0	0	2	0	3	0	2	11	0	0	0	0	0	0	0	0	0	0	0
CA 10	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CA 11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 13	0	0	0	2	0	66	0	168	0	1	0	0	0	0	0	2	0	0	1	1	0	0	0	0	0
CA 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 20	4	18	38	47	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CA 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0
CA 23	0	0	0	0	0	0	0	2	0	0	5	0	1	0	0	0	0	0	0	2	0	0	0	0	1
CA 25	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0
CA 26	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 43	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 102	0	0	0	0	0	94	0	359	0	0	0	0	0	0	0	1	9	0	4	0	17	27	409	229	220
CA 104	0	0	0	0	0	10	0	23	0	0	0	1	0	0	0	0	10	0	0	0	56	56	121	136	69
CA 105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
CA 107	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CA 108	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
CA 109	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0
CA 110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
CA 112	1	0	0	0	0	60	0	6	0	0	0	0	0	1	0	2	9	0	0	0	0	1	23	3	25
CA 114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 115	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	4	0	0	0	1	2	86	11	31
CA 116	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
CA 118	0	0	0	0	0	5	0	0	0	0	0	0	0	1	4	0	1	0	0	0	1	11	0	1	4
CA 119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
CA 120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 121	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	7	0	0	0	3	3	1	2	5
CA 123	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
CA 124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 125	0	0	0	0	0	2	0	10	0	0	0	0	0	0	0	0	0	0	0	0	25	61	536	648	414
CA 126	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	8	7	16	18
CA 127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 129	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 130	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
CA 132	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 133	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CA 134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 135	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
CA 137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 140	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0	0	6	0	0	0	0	0
CA 141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 144	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 155	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 157	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 160	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 164	5	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1
CC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 4	0	0	0	0	0	76	0	25	0	0	0	0	1	1	0	56	25	0	6	1	0	3	17	10	7
CC 101	0	0	0	0	0	1	0	0	0	0	0	0	0	9	4	0	10	0	0	0	39	31	9	8	56
CC 104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0
CT 1	0	0	1	0	0	50	4	125	3	5	0	0	0	0	0	5	5	0	1	51	0	0	0	5	0

Cont.

Spatial Data (Cont.).

Taxon	Carpoglossum					Caulocystis					Hemineura					C. retroflexa					Halopteris				
CT 2	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0
CT 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 101	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
CI 1	0	0	0	0	0	0	5	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 2	0	0	0	0	0	15	0	5	0	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
CI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 4	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
CI 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	5	1	3	0	0	0	0	0	0
CI 6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6	0	0	0	1	0	0	0	0	0	0
CI 11	0	3	0	1	0	0	0	0	0	0	6	3	0	0	0	0	0	2	0	39	0	0	0	0	0
CI 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0
CI 13	0	11	0	0	0	0	0	0	0	0	0	19	7	0	0	0	0	1	0	0	0	0	0	0	0
CI 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 15	0	0	0	0	0	0	0	0	0	0	0	12	0	4	0	0	0	0	0	0	0	0	0	0	0
CI 16	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 19	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
CI 27	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CI 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CI 41	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0
CM 1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
CU 1	0	0	0	0	0	0	1	0	1	2	0	0	2	0	0	0	0	0	0	4	0	0	0	0	0
CU 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CD 1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0
CD 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CD 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0
CD 4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CB 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TA 1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
PL 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
VI 9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	0
VI 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 2	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1
AP 3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AP 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EO 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
EE 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA 1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI 1	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0
MG 1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0
MG 2	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
MG 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MG 5	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0
MG 7	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0	0	0	0	0	26	0	0	0	0	0
MG 8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 26	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MG 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Carpoglossum					Caulocystis					Hemineura					C. retroflexa					Halopteris				
MG 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG 50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MG 102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	2	3
MG 103	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
MG 104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0
MA 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 1	3	0	1	0	0	3	5	2	17	16	0	6	19	0	0	0	8	12	0	109	0	0	0	2	2
MP 2	0	1	0	0	0	11	21	4	12	44	0	2	0	0	0	0	5	5	0	52	1	3	1	7	9
MP 3	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2	8	6	16	10
MP 4	0	0	0	0	0	0	0	0	0	0	2	3	7	0	0	0	0	1	0	0	0	0	0	0	0
MP 5	1	0	1	0	0	16	1	121	0	0	0	0	0	0	2	5	11	0	0	9	1	1	7	0	4
MP 6	1	0	0	0	0	0	2	0	0	10	0	5	0	0	1	0	0	1	0	21	0	0	0	0	0
MP 7	0	0	0	0	0	3	11	0	6	6	1	4	1	3	0	0	1	1	1	53	0	2	0	2	1
MP 8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 9	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
MP 10	1	0	0	1	0	3	23	0	22	20	2	6	6	0	2	0	1	0	0	100	0	0	1	1	0
MP 11	0	0	0	0	0	0	1	0	1	3	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
MP 12	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
MP 13	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
MP 14	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MP 15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MP 16	0	0	0	0	0	0	2	0	3	2	1	0	0	0	0	0	0	0	0	15	0	0	0	0	0
MP 17	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	1	0	0
MP 18	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MP 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MP 24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MP 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 29	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
MP 33	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 60	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1
MP 62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MP 101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 108	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
MP 109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MP 112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 117	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
MP 118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MP 121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MO 3	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
MN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
MN 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2
MN 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
MN 13	0	0	0	0	0	0	0	0	0	0	5	0	0	1	1	0	0	0	0	0	0	0	0	0	0
MN 14	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0
MN 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MN 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3. Fancy Point Spatial Data.

Taxon	Jeannerettia					Caulerpa geminata				
CA 1	5	5	1	1	5	0	0	0	0	0
CA 2	5	1	0	1	0	0	0	0	1	2
CA 3	0	0	0	0	0	0	0	0	0	0
CA 4	0	0	0	0	0	0	2	1	11	5
CA 5	0	0	0	0	0	0	0	0	0	0
CA 6	0	0	0	0	0	0	0	0	0	2
CA 8	0	0	0	0	0	0	0	0	0	0
CA 9	0	0	0	11	0	0	0	0	0	0
CA 10	0	0	0	1	0	3	0	0	0	0
CA 11	0	0	0	0	0	0	0	0	1	0
CA 12	0	0	0	0	0	0	1	0	0	1
CA 13	0	0	0	0	0	0	0	0	0	0
CA 15	0	0	0	0	0	0	0	1	0	1
CA 17	0	0	0	0	0	0	0	0	0	0
CA 20	0	0	0	0	0	0	0	0	0	0
CA 21	0	0	0	0	0	0	0	0	0	0
CA 23	0	0	0	0	0	0	0	0	0	0
CA 25	16	32	3	10	15	0	0	0	0	0
CA 26	0	0	0	0	0	0	0	1	0	0
CA 32	0	0	0	0	0	0	0	1	0	0
CA 42	0	1	1	0	0	0	0	0	0	0
CA 102	2	10	2	6	1	0	0	0	0	0
CA 104	0	1	1	0	0	0	0	0	0	0
CA 105	1	0	0	0	0	0	0	0	0	0
CA 107	1	10	1	0	1	0	0	0	0	0
CA 108	0	0	1	0	0	1	0	0	0	0
CA 109	0	2	0	1	0	0	0	0	0	0
CA 110	0	0	0	0	0	0	0	0	0	0
CA 111	1	0	0	0	0	0	0	0	0	0
CA 112	3	12	5	10	4	0	0	0	0	0
CA 114	0	0	0	0	0	0	0	0	0	0
CA 115	0	1	0	0	2	0	0	0	0	0
CA 116	3	0	0	0	0	0	0	0	0	0
CA 117	0	0	0	0	0	1	0	0	0	0
CA 118	0	8	1	2	1	0	0	0	0	0
CA 119	0	5	0	0	0	0	0	0	0	0
CA 120	0	0	0	0	0	0	0	0	0	0
CA 121	1	2	0	2	0	0	0	0	0	0
CA 123	0	0	0	1	0	0	0	0	0	0
CA 124	1	0	0	0	0	0	0	0	0	0
CA 125	0	7	1	0	0	0	0	0	0	0
CA 126	0	0	3	4	0	1	0	0	0	0
CA 127	0	0	0	0	0	0	0	0	0	0
CA 128	0	0	0	0	0	0	0	0	0	0
CA 129	0	0	0	0	0	1	0	0	0	0
CA 130	0	0	0	1	0	0	0	0	0	0
CA 132	0	0	0	0	0	0	0	3	0	1	0
CA 133	0	0	0	0	0	0	0	0	1	0	0
CA 134	0	0	0	0	0	0	0	0	0	0	0
CA 135	0	0	0	0	0	5	0	0	0	0	0
CA 137	0	0	0	0	0	0	0	0	0	0	0
CA 139	0	0	0	0	0	6	0	0	0	0	0
CA 140	0	0	0	0	0	0	0	0	0	0	0
CA 141	0	0	0	0	0	0	0	0	0	0	0
CA 142	0	0	0	0	0	0	0	0	0	0	0
CA 143	0	0	0	0	0	0	0	0	0	0	0
CA 144	0	0	0	0	0	0	0	0	0	0	0
CA 147	0	0	0	0	0	0	0	0	0	0	0
CA 149	0	0	0	0	0	0	0	0	0	0	0
CA 150	0	0	0	0	0	0	0	0	0	0	0
CA 151	0	0	0	0	0	0	0	0	0	0	0
CA 152	0	0	0	0	0	0	0	0	0	1	0
CA 154	0	0	0	0	0	0	0	0	0	0	0
CA 155	0	0	0	0	0	0	0	0	0	0	0
CA 157	0	0	0	0	0	0	0	0	0	3	0
CA 159	0	0	0	0	0	0	0	0	0	0	0
CA 160	0	0	0	0	0	0	0	0	0	0	0
CA 161	0	0	0	0	0	0	0	0	0	0	0
CA 163	0	0	0	0	0	0	0	0	0	0	0
CA 164	0	4	8	5	1	0	0	0	0	0	0
CC 1	0	0	0	0	0	0	0	0	0	0	0
CC 2	0	0	0	0	0	0	0	0	0	0	0
CC 4	11	15	2	25	11	0	0	0	0	0	0
CC 101	1	3	1	0	1	0	0	0	0	0	0
CC 104	0	0	0	0	0	0	0	0	0	0	0
CT 1	0	1	0	0	0	0	0	0	0	0	0
CT 2	0	0	1	1	0	0	1	0	0	2	

Cont.

Spatial Data (Cont.)

Taxon	Jeannerettia					Caulerpa geminata				
CT 3	0	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	0	0	0	0	0	5	3
CT 5	0	0	0	0	0	0	0	0	0	0
CT 10	0	1	1	0	0	0	0	0	0	0
CT 11	0	1	0	0	0	0	0	0	0	0
CT 2	0	0	0	0	0	0	0	0	0	0
CT 3	0	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	0	0	0	0	0	0	0
CT 5	0	0	0	0	0	0	0	0	0	0
CT 9	3	1	4	1	0	0	0	0	0	0
CT 11	0	1	0	1	0	0	5	0	1	1
CT 12	0	0	0	0	0	0	0	0	0	0
CT 13	0	0	0	0	0	0	0	0	0	0
CT 14	0	0	0	0	0	0	0	0	0	0
CT 15	0	0	0	0	0	0	9	18	6	7
CT 16	1	0	0	0	0	8	2	0	1	5
CT 18	1	0	0	0	0	0	4	2	3	1
CT 19	0	0	0	0	0	0	0	0	0	0
CT 20	0	0	0	0	0	0	0	0	0	3
CT 21	0	0	0	0	0	0	0	0	0	7
CT 22	0	0	0	0	0	0	0	0	0	4
CT 24	0	0	0	0	2	0	0	0	0	0
CT 25	0	0	0	0	0	0	0	0	0	0
CT 26	0	0	0	0	0	0	0	0	0	0
CT 27	0	0	0	0	0	0	0	0	0	0
CT 31	0	0	0	0	0	0	0	0	0	0
CM 1	1	0	0	0	0	0	1	0	0	0
CM 2	0	0	0	0	0	0	1	0	0	0
CB 2	0	0	0	0	0	2	0	0	0	0
CB 1	0	0	0	0	0	0	0	0	0	0
CB 2	0	0	0	0	0	0	0	0	0	0
CB 3	0	0	0	0	0	0	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0
CB 1	0	0	0	0	0	0	0	0	0	0
CB 2	0	0	0	0	0	0	0	0	0	0
CB 3	0	0	0	0	0	1	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0
CP 1	0	0	0	0	0	0	0	0	0	0
SA 1	0	0	0	0	0	0	0	0	0	0
SA 2	0	0	0	0	0	0	0	0	0	0
CZ 1	0	0	0	0	0	0	0	0	0	0
TA 1	0	0	0	0	0	0	0	0	0	0
PL 1	0	0	0	0	1	0	0	0	0	0
PL 2	0	0	0	0	0	0	0	0	0	0
PL 11	0	2	0	0	0	0	1	0	0	0
PL 12	0	0	0	0	0	0	0	0	0	0
VI 3	0	0	0	0	0	0	0	0	0	0
VI 9	0	0	0	0	0	0	0	0	0	0
VI 10	0	0	0	0	0	0	0	0	0	0
VI 11	0	0	0	0	0	0	0	0	0	0
AP 1	0	0	0	0	0	0	0	0	0	0
AP 2	0	1	0	2	0	0	0	0	0	1
AP 3	1	0	1	0	0	0	0	0	0	0
AP 4	1	0	0	0	0	0	0	0	0	0
SE 1	0	0	0	0	0	0	0	0	0	0
SE 2	0	0	0	0	0	0	0	1	0	1
SH 3	0	0	0	1	0	0	0	0	0	0
EC 1	0	0	0	0	0	4	0	1	0	3
EL 1	0	0	0	0	0	0	0	0	0	0
EA 1	0	0	0	0	0	0	1	0	0	0
EA 2	0	0	0	0	0	0	0	0	0	0
AI 1	0	0	0	0	0	0	0	0	0	1
MG 1	0	0	0	0	0	0	0	1	2	1
MG 2	0	0	0	0	0	0	0	0	0	0
MG 3	0	0	0	0	3	0	6	1	0	0
MG 4	0	0	0	0	0	0	0	0	0	0
MG 5	0	0	2	0	0	0	0	0	0	0
MG 7	0	0	0	1	1	0	6	2	8	6
MG 8	0	0	0	0	0	0	0	0	0	0
MG 10	0	0	0	0	0	1	0	0	0	0
MG 11	0	0	0	0	0	0	1	0	1	0
MG 13	0	1	0	0	0	0	0	0	0	0
MG 15	0	0	0	0	0	0	0	0	0	0
MG 18	0	0	0	0	0	0	0	0	1	1
MG 26	0	0	0	0	0	0	0	0	0	0
MG 32	0	0	0	0	0	0	0	0	0	0

Cont.

Spatial Data (Cont.).

Taxon	Jeannerettia					Caulerpa geminata				
MG 37	0	0	0	0	0	0	0	0	0	0
MG 49	0	0	0	0	0	0	0	0	0	0
MG 59	0	0	0	0	0	0	0	0	0	1
MG 101	0	1	0	0	0	0	0	0	0	0
MG 102	0	0	0	0	0	0	0	0	0	0
MG 103	0	0	0	0	0	1	0	0	0	0
MG 104	0	0	0	0	0	1	0	0	0	0
MG 105	0	0	0	0	0	0	1	0	0	0
MG 106	0	0	0	0	0	0	0	0	0	0
MG 107	0	0	0	0	0	0	0	0	1	0
MG 108	0	0	0	0	0	0	0	0	1	0
MG 109	0	0	0	0	0	0	0	0	0	0
MA 4	0	0	0	0	0	0	0	0	0	1
WP 1	2	0	0	0	0	0	0	4	4	3
WP 2	7	3	5	0	0	0	0	0	0	0
WP 3	0	0	0	1	0	0	0	0	0	0
WP 4	0	0	0	0	0	0	0	0	1	0
WP 5	4	13	13	46	3	0	0	0	0	0
WP 6	0	0	0	1	1	1	1	3	2	2
WP 7	0	5	5	1	2	5	3	5	7	6
WP 8	0	0	0	0	0	0	0	0	1	2
WP 9	0	0	0	1	0	1	0	0	0	0
WP 10	1	0	0	0	1	0	3	1	3	7
WP 11	0	0	0	0	0	0	2	0	0	0
WP 12	0	0	0	0	0	0	1	0	0	1
WP 13	0	0	0	1	0	0	0	0	0	0
WP 14	0	25	3	3	0	0	0	0	0	0
WP 15	0	0	0	0	0	0	0	0	1	0
WP 16	0	0	0	0	0	0	2	1	1	2
WP 17	2	4	1	0	1	0	2	0	0	1
WP 18	0	0	0	0	0	0	0	0	0	0
WP 20	0	0	0	0	0	0	0	0	0	0
WP 21	0	0	2	0	0	0	0	0	0	0
WP 24	0	0	0	0	0	0	0	0	0	0
WP 25	1	0	0	0	0	0	0	0	0	0
WP 26	0	0	0	0	0	0	0	0	0	0
WP 29	0	0	0	0	0	0	0	1	0	0
WP 30	0	0	0	0	0	0	0	0	0	2
WP 31	0	0	0	0	0	0	0	0	0	0
WP 33	0	0	0	0	0	0	0	0	0	0
WP 34	0	0	0	0	0	0	0	0	0	0
WP 35	0	0	0	0	0	0	4	0	0	0
WP 39	0	0	0	0	0	0	0	0	0	0
WP 42	0	0	0	0	0	0	0	0	0	0
WP 51	0	0	0	0	0	0	0	0	0	0
WP 53	0	0	0	0	0	0	0	0	0	0
WP 59	0	0	0	0	0	0	0	0	0	0
WP 60	0	0	0	0	0	0	0	0	0	0
WP 62	0	0	0	0	0	0	0	0	0	0
WP 101	0	0	0	0	0	0	0	0	0	0
WP 106	0	0	0	0	0	0	0	0	0	0
WP 107	0	0	0	0	0	0	0	0	0	0
WP 108	0	1	3	0	1	1	0	0	0	1
WP 109	0	0	0	0	0	1	0	0	0	0
WP 112	0	0	0	0	0	0	0	0	0	0
WP 113	0	0	0	0	0	0	0	0	0	0
WP 114	0	0	0	0	0	0	0	0	0	0
WP 115	0	0	0	0	0	0	0	0	0	0
WP 116	0	0	0	0	0	0	0	0	0	0
WP 117	0	0	0	0	0	0	0	0	0	0
WP 118	0	0	0	0	0	0	0	0	0	0
WP 119	0	0	0	0	0	0	0	0	0	0
WP 120	0	0	0	0	0	0	0	0	0	0
WP 121	0	0	0	0	0	0	0	0	0	0
WG 1	0	0	0	0	0	0	0	0	0	0
WG 2	0	0	0	0	0	0	0	0	1	0
WG 3	0	0	0	0	0	0	0	2	1	3
WN 1	0	0	0	0	0	0	0	0	0	0
WN 2	0	0	0	0	0	0	0	0	0	0
WN 3	0	0	0	0	0	0	0	0	0	0
WN 11	1	7	0	5	2	0	0	0	0	0
WN 12	0	0	0	1	0	0	0	0	0	0
WN 13	0	0	0	0	0	0	0	0	0	0
WN 14	0	0	0	0	0	0	0	0	0	0
WN 15	0	0	0	0	0	0	0	0	0	0
WN 16	0	0	0	0	0	0	0	0	0	0

APPENDIX 4: LATITUDINAL DATA

The abundances of phytal animal taxa (rows) associated with each plant (columns) collected during the latitudinal sampling program. Note that some of the plant species have not been included in analyses described in the text. Abbreviations of taxa are not consistent between sites but are listed under animal group (CA Gammaridean Amphipoda, CC Caprellid Amphipoda, CT Tanaidacea, CI Isopoda, CU Cumacea, CD Decapoda, CN Leptostraca, CB Brachyura, CS Stomatopoda, CM Mysidacea, CO Porcellanid Anomura, CP Pagurid Anomura, EO Ophiuroidea, EA Asteroidea, EH Holothuroidea, EC Crinoidea, AP Pycnogonida, AT Trichoptera, AI Diptera, PL Platyhelminthes, VI Ichthyes, TA Actiniaria, SA Chaetognatha, MG Gastropoda, MA Amphineura, WP Polychaeta, WO Oligochaeta, WH Hirudinea, WN Nemertea). Sampling sites, date of collection and total dry weight of algae (with number of replicates in parentheses) are as follows:

Locality	Algal Species	Dry Weight (g)
Yonge Reef (25/9/79)	Halimeda opuntia	62.6 (10)
Lizard Island (20-30/9/79)	Padina tenuis	34.9 (10)
	Halimeda cylindracea	82.2 (10)
	Halimeda opuntia	88.6 (10)
	Galaxaura sp.	19.2 (10)
	Chlorodesmis fastigiata	11.0 (10)
	Turbinaria ornata	22.9 (10)
	Hypnea sp.	12.5 (10)
Wentworth Reef (11/8/81)	Sargassum sp.1	13.8 (5)
	Sargassum sp.2	37.2 (5)
	Sargassum sp.3	28.5 (5)
	Padina tenuis	5.18 (5)
	Lobophora variegata	11.6 (5)
Russel Is. (8/8/81)	Padina tenuis	6.66 (5)
Magnetic Is. (14/8/81)	Sargassum sp.	27.9 (5)
	Lobophora variegata	17.1 (5)
Slade Pt (16/8/81)	Sargassum sp.	23.2 (5)
	Padina tenuis	4.21 (5)

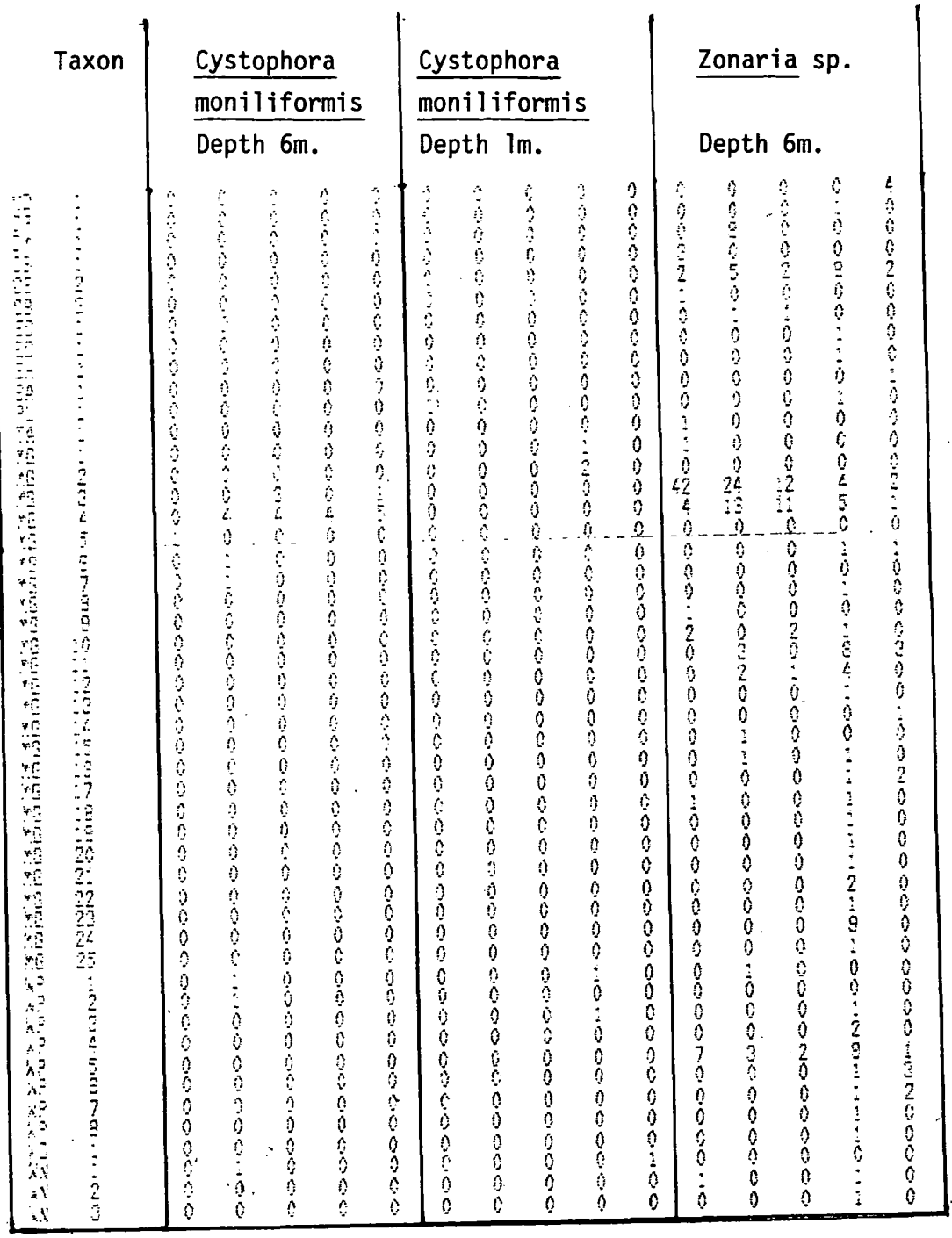
Locality	Algal Species	Dry Weight (g)	
Yeppoon (17/8/81)	Sargassum sp.	26.0	(5)
	Padina tenuis	7.04	(5)
Caloundra (18/8/81)	Zonaria sp.	7.12	(5)
North Stradbroke Is. (Sep 81)	Sargassum sp.	125	(5)
Minniewater (27/7/81)	Sargassum sp.	33.3	(5)
	Zonaria sp.	10.5	(5)
Broughton Is. (18/8/79)	Zonaria sp.	19.6	(10)
	Caulocystis sp.	118	(10)
	Dilophus marginatus	5.58	(5)
Halifax Pt (25/7/81)	Sargassum sp.	16.4	(5)
Avalon (23/7/81)	Zonaria sp.	6.19	(5)
Mallacoota (18/7/81)	Zonaria sp.	14.5	(5)
	Caulocystis cephalornithos	15.3	(5)
Fisher Is. (1/8/80)	Caulocystis cephalornithos	71.8	(10)
Cape Portland (11/1/81)	Sargassum bracteolosum	49.2	(5)
	Caulocystis cephalornithos	46.5	(5)
One Tree Point (10/11/81)	Zonaria sp.	10.9	(5)
	Cystophora moniliformis (1m)	46.6	(5)
	Cystophora moniliformis (6m)	24.5	(5)

One Tree Point, Bruny Island.

Taxon	Cystophora moniliformis Depth 6m.	Cystophora moniliformis Depth 1m.	Zonaria sp. Depth 6m.

Cont.

One Tree Point. (Cont.).

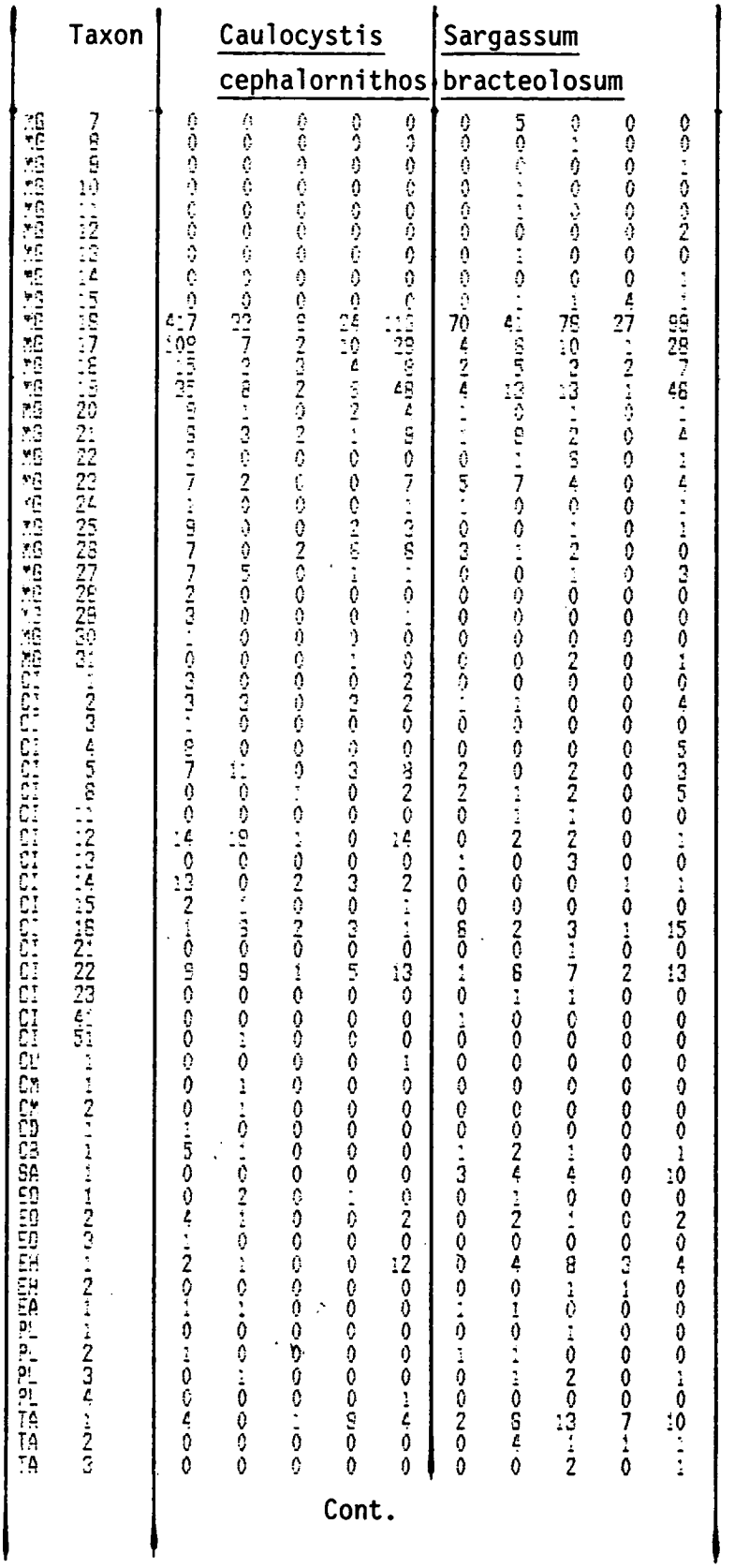


Cape Portland. Depth 3 m.

Taxon	Caulocystis cephalornithos					Sargassum bracteolosum				
CA 1	3	0	0	3	10	4	0	0	1	0
CA 2	5	3	0	0	9	4	2	2	0	18
CA 3	9	0	0	0	0	0	0	2	0	4
CA 4	0	6	0	0	0	0	0	0	0	0
CA 5	0	2	0	3	0	0	3	0	0	2
CA 6	2	0	0	0	0	0	5	2	0	0
CA 7	0	0	0	0	0	4	0	0	0	5
CA 8	0	0	2	0	0	19	14	18	0	18
CA 9	0	0	0	0	0	0	0	0	0	0
CA 10	11	0	0	7	17	0	0	0	2	0
CA 11	2	4	0	2	3	0	0	2	0	3
CA 12	7	2	0	0	0	18	9	4	3	21
CA 13	4	0	0	2	21	0	0	0	0	0
CA 14	0	0	0	0	0	0	0	1	0	0
CA 15	8	0	0	0	3	2	0	0	0	0
CA 16	0	0	0	0	0	0	0	1	0	0
CA 17	103	0	0	8	27	10	0	0	0	0
CA 18	0	0	0	0	0	0	0	0	3	0
CA 20	25	5	2	4	0	10	13	15	5	30
CA 21	22	0	0	7	0	7	4	2	0	0
CA 22	5	0	0	0	0	7	8	21	0	8
CA 23	9	0	0	0	0	0	0	0	0	0
CA 24	5	0	0	0	0	0	0	2	0	0
CA 25	0	0	0	0	0	0	15	18	0	44
CA 26	0	0	0	0	0	0	0	0	0	18
CA 27	35	0	0	0	0	0	0	0	0	0
CA 28	4	0	0	0	0	0	0	0	0	0
CA 29	0	0	0	0	0	0	0	0	0	0
CA 30	22	2	0	0	2	0	1	0	0	0
CA 32	0	0	0	0	0	0	0	2	0	0
CA 33	0	0	0	0	0	0	5	0	0	0
CA 34	0	0	0	0	0	0	0	0	1	0
CA 35	0	0	0	0	0	0	0	0	0	0
CA 36	0	0	0	0	0	0	0	0	0	9
CA 37	0	0	0	0	0	0	0	0	0	0
CA 38	0	0	0	0	0	0	0	0	0	0
CA 40	0	0	0	0	0	0	0	0	0	0
CA 41	0	0	0	0	0	0	0	0	0	0
CA 42	0	0	0	0	1	0	0	0	0	0
CA 43	0	0	0	0	0	0	0	0	0	0
CA 44	13	0	0	0	5	0	0	26	0	5
CA 46	2	0	0	0	23	0	0	0	0	0
CA 47	18	0	0	0	0	0	0	0	0	0
CA 48	4	0	0	2	1	0	3	3	0	7
CA 49	0	0	0	0	0	0	2	0	0	6
CA 50	2	0	0	0	0	0	0	0	0	0
CA 51	5	0	0	0	0	0	0	0	0	0
CA 52	5	0	0	0	4	0	4	0	0	9
CA 53	21	0	0	2	0	0	1	1	0	1
CA 54	19	75	0	29	25	0	8	3	0	14
CA 55	0	0	0	0	0	0	0	0	0	0
CA 56	16	2	0	0	0	0	5	8	0	0
CA 57	0	0	0	0	0	0	0	0	0	0
CA 58	14	5	0	0	5	0	4	0	0	0
CA 59	0	0	0	0	0	0	0	0	0	0
CA 60	34	25	0	15	22	3	8	3	0	22
CA 61	3	0	0	2	2	4	12	12	2	25
CA 62	0	0	0	2	0	0	0	0	0	0
CA 63	0	0	0	0	0	2	11	8	0	3
CA 64	0	0	0	0	0	2	5	2	0	3
CA 65	0	2	0	0	0	0	0	0	0	0
CA 66	0	0	0	0	0	0	0	0	0	0
CA 67	0	0	0	0	0	0	0	0	0	0
CA 68	0	0	0	0	0	0	0	0	0	0
CA 69	0	0	0	0	1	0	0	0	0	0
CA 70	0	0	0	0	0	0	0	0	0	0
CA 71	0	0	0	0	0	0	0	0	0	1

Cont.

Cape Portland (Cont.)



Cape Portland (Cont.).

Taxon	Caulocystis cephalornithos					Sargassum bracteolosum				
AP 1	2	2	0	0	0	2	2	2	0	0
AP 2	0	0	0	0	0	0	0	1	0	5
AP 3	10	1	0	2	5	2	5	10	0	10
AP 4	3	3	0	1	3	3	4	4	0	4
AP 5	29	7	0	2	7	0	1	4	0	6
AP 6	0	0	0	0	0	0	0	1	0	0
AP 7	3	1	0	0	4	0	2	9	0	0
AP 8	2	0	0	0	1	1	1	1	0	0
AP 9	5	1	0	2	1	0	1	3	0	1
AP 10	40	14	1	13	12	7	19	34	2	31
AP 11	10	5	0	5	5	3	1	5	0	5
AP 12	2	0	0	0	1	0	2	1	0	0
AP 13	38	20	6	12	25	18	3	11	2	6
AP 14	0	2	0	0	0	0	0	0	0	0
AP 15	4	0	0	1	1	0	0	0	0	3
AP 16	3	5	0	2	0	0	2	3	1	3
AP 17	0	0	0	0	0	0	2	0	0	0
AP 18	0	0	0	0	0	0	1	1	0	0
AP 19	3	0	0	0	0	0	2	0	0	0
AP 20	0	0	0	0	0	4	5	8	1	5
AP 21	2	0	0	0	0	0	0	0	0	0
AP 22	0	0	0	0	0	0	0	1	0	0
AP 23	10	3	0	0	10	2	0	4	0	1
AP 24	0	0	0	0	0	0	0	1	0	1
AP 25	2	2	2	0	2	0	1	2	0	3
AP 26	0	0	0	0	1	0	0	0	0	0
AP 27	0	0	0	0	0	2	1	2	0	1
AP 28	0	0	0	0	0	0	1	0	0	0
AP 29	0	0	0	0	0	0	3	1	0	0
AP 30	0	0	0	0	0	0	1	0	0	0
AN 1	3	1	0	1	3	0	0	0	0	1
AN 2	3	0	0	0	3	1	0	4	1	0
AN 3	1	0	0	0	0	0	0	0	0	0

Fisher Island. Depth 0.5m.

Taxon	Caulocystis cephalornithos									
CA	9	0	2	29	2	13	17	6	15	85
CA	12	0	4	18	0	2	11	0	2	7
CA	1	0	0	0	0	0	2	0	0	0
CA	7	0	0	26	2	3	7	5	2	22
CA	1	0	12	15	0	9	4	4	3	47
CA	0	0	23	0	0	0	5	0	0	8
CA	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	10	0	0	0
CA	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	12	0	2	0	2	3	4
CA	2	0	0	0	0	0	4	0	0	0
CA	0	0	0	0	0	0	0

Mallacoota. Depth 6m.

Taxon	Caulocystis cephalornithos					Zonaria sp.				
	104	3	4	10	2	47	343	175	58	162
	0	0	0	1	0	5	10	5	5	1
	0	0	0	2	0	54	19	5	1	2
	0	0	0	0	0	1	0	2	0	0
	0	0	0	0	0	7	0	0	0	2
	38	34	15	28	2	1	5	0	0	0
	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	3	2	0	1	0
	0	2	0	0	0	3	0	1	1	0
	0	0	3	0	0	5	2	0	0	3
	2	5	0	2	0	1	1	8	4	0
	0	0	0	0	3	5	0	0	3	0
	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	1	0	3
	2	0	0	1	0	0	0	0	12	0
	0	0	0	0	0	0	1	8	0	1
	0	0	0	0	0	20	9	4	0	0
	0	0	0	0	0	22	2	2	3	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	5	0	0	0	0
	0	0	0	0	0	2	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	1	1	0	0
	2	0	0	0	0	0	0	0	0	2
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0

Avalon. Depth 5m.

Taxon	Zonaria sp.				
CA 1	2	2	14	2	2
CA 2	0	0	0	0	3
CA 3	10	0	0	4	2
CA 4	0	3	3	3	0
CA 5	0	0	0	1	0
CA 6	0	3	3	3	4
CA 7	0	7	4	7	5
CA 8	14	6	7	3	3
CA 9	0	3	10	2	0
CA 10	0	5	0	2	2
CA 11	0	0	0	0	0
CA 12	0	0	0	0	0
CA 13	0	0	0	0	1
CA 14	0	0	2	4	4
CA 15	0	0	2	0	0
CA 16	0	0	0	2	0
CA 17	0	0	0	0	0
CA 18	0	0	0	2	0
CA 19	0	0	0	0	0
CA 20	0	0	0	4	0
CA 21	0	0	0	0	0
CA 22	0	0	0	0	0
CA 23	0	0	0	0	0
CA

Halifax Point. Depth 1m.

Taxon		Sargassum sp.				
CA	1	61	60	32	27	23
CA	2	40	6	1	9	5
CA	3	65	34	0	2	1
CA	4	1	0	7	1	1
CA	5	9	9	1	8	7
CA	6	0	1	1	0	0
CA	7	0	0	2	0	0
CA	8	0	1	0	0	0
CA	9	0	3	0	0	0
CA	10	0	0	0	1	0
CA	11	1	0	1	0	0
CA	12	1	0	0	0	0
CA	13	2	24	8	11	0
CA	14	8	17	10	0	1
CA	15	7	14	25	21	5
CA	16	13	17	17	10	0
CA	17	32	8	3	4	1
CA	18	86	14	3	2	8
CA	19	85	23	3	20	28
CA	20	0	1	0	7	0
CA	21	1	3	0	6	0
CA	22	13	10	0	0	15
CA	23	1	0	0	0	0
CA	24	3	7	0	2	0
CA	25	1	0	0	0	0
CC	1	1	0	0	0	0
CC	2	1	25	4	0	2
CC	3	32	0	1	0	0
CC	4	55	72	21	34	6
CT	1	0	2	0	1	0
CI	1	0	1	1	0	0
CI	2	0	0	1	0	0
CI	11	0	2	1	2	0
CI	21	0	0	2	1	0
CU	1	0	0	1	0	0
CU	2	0	0	1	0	0
CB	1	0	1	0	0	0
AP	1	2	1	1	0	0
AI	1	0	0	0	0	1
PL	1	2	0	1	1	0
PL	2	0	0	1	0	0
PL	3	21	9	1	2	1
EO	1	0	1	0	1	0
EO	2	0	1	0	0	0
EO	3	0	0	0	1	0
TA	1	1	0	2	0	0
MG	1	0	6	0	0	2
MG	2	0	0	1	0	0
MG	3	0	14	10	5	1
MG	4	1	0	0	0	0
MG	5	0	0	0	0	1
MG	6	7	3	50	0	1
MG	7	2	1	1	2	0
MG	8	0	0	2	0	0
MG	9	1	1	1	0	0
MG	10	0	4	1	1	0
MG	11	0	1	0	0	0
MG	12	0	1	2	0	0
MG	13	0	4	4	0	0
MG	14	0	0	3	0	0
MG	15	0	0	1	0	0
MG	16	0	1	2	0	0
MG	17	0	0	0	0	1
MP	1	3	3	5	3	1
MP	2	1	0	0	0	0
MP	3	0	2	0	1	0
MP	4	2	9	0	3	1
MP	5	0	0	1	1	0
MP	6	1	7	3	0	3
MP	7	0	1	0	1	0
MP	8	0	0	1	0	0
MP	9	0	0	1	0	0
MP	10	0	0	0	1	0
MP	11	0	2	0	1	0
MP	12	0	3	0	2	0
MP	13	0	1	0	1	0
MP	14	1	0	0	1	1
MP	15	0	0	1	3	0
MN	1	0	1	0	4	0

Broughton Island. Depth 3m.

Taxon	Caulocystis sp.	Zonaria sp.	Dilophus marginatus

Cont.

Broughton Island. (Cont.).

Taxon	Caulocystis sp.	Zonaria sp.	Dilophus marginatus

Minniewater. Depth 1m.

Taxon	Sargassum sp.					Zonaria sp.				
	125	18	52	19	40	3	2	2	5	7
	18	9	5	9	2	0	0	0	0	0
	1	1	9	4	12	0	0	2	2	2
	0	0	0	0	0	1	0	0	0	1
	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	0	2	0	0
	0	0	0	0	0	0	0	0

Myora Light, North Stradbroke Island. Depth 0.1m.

Taxon		Sargassum sp.				
CA	1	7	0	0	0	0
CA	2	7	7	5	7	5
CA	3	41	95	195	138	582
CA	4	1	0	0	0	0
CA	5	162	188	291	175	258
CA	6	79	191	479	355	846
CA	7	10	0	2	0	0
CA	8	1	0	0	0	0
CA	9	0	1	0	0	0
CA	10	0	0	2	0	3
CA	11	0	0	0	0	1
CO	1	102	79	94	82	146
CO	[illegible]	19	29	39	23	47
CO	2	7	0	2	2	7
CO	[illegible]	8	9	59	29	42
CO	[illegible]	1	3	1	0	2
CO	[illegible]	1	0	1	1	0
CO	2	0	1	0	0	0
CO	[illegible]	2	5	4	3	1
CO	[illegible]	0	0	7	2	2
CO	[illegible]	0	0	0	1	0
CO	[illegible]	1	3	0	0	0
CO	2	1	3	1	0	0
MG	3	0	0	1	0	0
MG	[illegible]	0	0	0	1	0
MG	2	1	0	0	0	0
MG	[illegible]	27	21	99	50	89
MG	[illegible]	28	74	280	161	89
MG	5	29	27	82	81	75
MG	6	8	2	15	14	10
MG	7	7	14	42	37	53
MG	8	0	1	3	0	0
MG	9	0	2	0	5	0
MG	10	0	0	1	0	0
MG	11	0	2	0	0	0
MG	12	0	0	3	1	2
MG	13	0	2	10	7	4
MP	1	0	1	0	0	0
MP	2	2	4	0	3	0
MP	3	0	0	0	2	0
MP	4	1	0	0	0	0
MP	5	0	1	0	0	0
MP	6	0	0	2	0	0
MN	1	0	1	0	0	0
MN	2	0	0	0	0	1

Caloundra. Depth 4m.

Taxon	Zonaria sp.				
CA 1	5	2	2	18	4
CA 2	2	2	1	9	8
CA 3	0	1	2	0	0
CA 4	3	3	5	1	0
CA 5	0	0	0	0	1
CA 6	0	3	0	0	1
CA 7	0	0	4	0	0
CA 8	2	0	0	0	0
CA 9	2	0	0	0	0
CA 10	4	5	0	6	1
CA 11	2	12	3	13	1
CA 12	4	0	3	5	1
CA 13	1	0	1	0	0
CA 14	1	0	0	2	0
CA 15	1	0	2	3	0
CA 16	0	0	0	4	6
CA 17	0	0	4	0	0
CC 1	2	0	0	0	0
CT 1	0	0	0	0	1
CT 2	0	0	0	0	1
CB 1	1	0	0	0	0
CU 1	1	0	0	0	0
CP 1	0	0	0	0	1
CI 1	0	3	6	4	5
CI 11	8	4	6	9	1
CI 12	1	0	1	2	0
CI 21	0	0	0	1	1
AP 1	1	0	0	0	0
AP 2	0	0	1	2	2
PL 1	1	0	2	3	1
PL 2	0	0	0	0	1
EG 1	0	0	1	0	1
MG 1	0	1	0	0	0
MG 2	1	1	0	4	0
MG 3	0	0	0	1	1
MG 4	1	0	0	0	0
MG 5	16	6	2	9	12
MG 6	2	1	0	0	2
MG 7	0	0	0	1	0
MP 1	0	1	0	0	0
MP 2	0	0	0	1	0
MP 3	3	2	3	1	1
MP 4	2	0	2	5	8
MP 5	0	0	0	1	0
MP 6	0	0	0	0	3
MP 7	0	0	0	1	0
MP 8	0	0	0	0	2
MN 1	0	1	1	4	2

Yeppoon. Depth 3m.

Taxon	Sargassum sp.					Padina tenuis				
	20	43	10	4	0	0	0	0	0	0
	11	33	4	0	3	0	0	2	0	1
	1	0	0	0	0	0	0	0	0	2
	0	0	0	0	0	1	1	0	0	0
	3	35	2	0	2	0	0	3	0	0
	0	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	2	0	5
	0	4	0	0	0	0	0	0	0	0
	0	10	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	1	0
	1	2	0	0	0	0	0	1	0	1
	15	4	2	3	1	0	0	0	1	0
	58	72	9	4	23	0	0	7	1	0
	45	10	11	4	3	0	0	0	0	1
	0	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	4	1	2
	0	0	0	0	0	0	0	0	0	1
	58	92	18	11	3	0	0	0	5	4
	12	3	0	0	15	0	0	12	1	0
	7	0	0	1	0	0	0	0	1	0
	2	0	0	0	1	0	0	1	0	1
	0	2	0	1	0	0	0	0	0	1
	0	0	0	0	0	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0
	0	0	0	0	2	0	0	0	0	0
	2	0	0	0	1	1	0	0	0	0
	0	0	0	0	1	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	19	34	4	4	10	0	0	4	2	5
	7	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	4	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	1	0
	0	1	5	0	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	0	1
	0	0	0	0	0	0	0	0	1	1
	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0
	15	13	4	3	11	0	0	2	0	0
	0	1	0	0	0	0	0	0	0	0
	0	2	0	0	3	2	0	9	2	2
	0	1	0	0	0	0	2	0	1	0
	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	0	0

Slade Point, Mackay. Depth 3m.

Taxon	Sargassum sp.					Padina tenuis				
	13	43	14	4	22	2	0	4	1	15
	1	2	0	2	0	0	0	0	0	0
	0	0	0	0	0	0	0	2	0	2
	0	0	0	0	0	0	0	0	0	0
	4	0	0	5	0	0	0	0	0	0
	10	9	4	12	7	0	2	10	2	2
	2	1	0	0	0	0	0	0	0	0
	15	1	2	4	13	2	0	0	0	0
	19	13	2	6	13	4	1	12	23	4
	2	0	0	0	1	0	0	0	0	0
	1	1	0	0	0	0	0	0	0	0
	1	1	0	0	2	0	1	0	1	2
	1	1	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0
	1	1	0	0	7	0	0	2	0	5
	0	2	2	2	0	0	0	0	0	2
	0	4	2	4	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	0	1
	0	0	0	0	0	0	0	1	0	1
	7	13	4	7	3	0	0	0	3	21
	25	13	12	9	1	0	0	0	1	7
	0	0	5	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	0
	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	1	0	1	2	1	11
	2	0	0	0	0	1	0	1	0	0
	2	2	0	0	0	0	0	6	3	0
	0	0	0	0	0	0	0	0	0	0
	26	4	0	1	4	1	0	0	1	0
	0	0	0	1	0	0	1	0	0	0
	2	0	0	1	4	0	0	0	0	0
	1	1	0	0	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0	0
	8	2	0	0	0	0	0	0	0	3
	0	1	0	3	0	0	0	0	0	3
	0	0	1	0	0	0	0	0	0	0
	1	0	0	2	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	0	0
	0	0	0	1	0	1	0	0	0	0
	4	1	0	0	1	0	0	0	0	0
	0	1	0	1	0	0	0	0	0	0
	0	1	2	0	0	0	0	0	0	0
	1	1	0	0	1	0	0	0	0	0
	1	1	0	1	2	0	0	0	0	0
	1	1	0	0	0	0	0	0	0	0
	1	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0
	0	1	0	4	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0	0
	0	0	0	0	5	0	0	0	0	0
	0	0	0	0	2	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	1	0	0	0	0
	4	0	0	0	0	0	0	0	0	2
	7	7	0	1	0	0	0	0	1	2
	28	0	2	1	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0
	4	0	0	2	1	0	0	2	0	0
	0	0	0	1	0	0	0	0	0	0
	5	2	22	2	2	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	0
	1	0	0	0	0	0	0	0	0	0

Magnetic Island. Depth 3m.

Taxon	Sargassum sp.	Lobophora sp.
1	6	0
2	0	12
3	0	8
4	2	7
5	2	3
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	1
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	0	0
46	0	0
47	0	0
48	0	0
49	0	0
50	0	0
51	0	0
52	0	0
53	0	0
54	0	0
55	0	0
56	0	0
57	0	0
58	0	0
59	0	0
60	0	0
61	0	0
62	0	0
63	0	0
64	0	0
65	0	0
66	0	0
67	0	0
68	0	0
69	0	0
70	0	0
71	0	0
72	0	0
73	0	0
74	0	0
75	0	0
76	0	0
77	0	0
78	0	0
79	0	0
80	0	0
81	0	0
82	0	0
83	0	0
84	0	0
85	0	0
86	0	0
87	0	0
88	0	0
89	0	0
90	0	0
91	0	0
92	0	0
93	0	0
94	0	0
95	0	0
96	0	0
97	0	0
98	0	0
99	0	0
100	0	0
101	0	0
102	0	0
103	0	0
104	0	0
105	0	0
106	0	0
107	0	0
108	0	0
109	0	0
110	0	0
111	0	0
112	0	0
113	0	0
114	0	0
115	0	0
116	0	0
117	0	0
118	0	0
119	0	0
120	0	0
121	0	0
122	0	0
123	0	0
124	0	0
125	0	0
126	0	0
127	0	0
128	0	0
129	0	0
130	0	0
131	0	0
132	0	0
133	0	0
134	0	0
135	0	0
136	0	0
137	0	0
138	0	0
139	0	0
140	0	0
141	0	0
142	0	0
143	0	0
144	0	0
145	0	0
146	0	0
147	0	0
148	0	0
149	0	0
150	0	0
151	0	0
152	0	0
153	0	0
154	0	0
155	0	0
156	0	0
157	0	0
158	0	0
159	0	0
160	0	0
161	0	0
162	0	0
163	0	0
164	0	0
165	0	0
166	0	0
167	0	0
168	0	0
169	0	0
170	0	0
171	0	0
172	0	0
173	0	0
174	0	0
175	0	0
176	0	0
177	0	0
178	0	0
179	0	0
180	0	0
181	0	0
182	0	0
183	0	0
184	0	0
185	0	0
186	0	0
187	0	0
188	0	0
189	0	0
190	0	0
191	0	0
192	0	0
193	0	0
194	0	0
195	0	0
196	0	0
197	0	0
198	0	0
199	0	0
200	0	0
201	0	0
202	0	0
203	0	0
204	0	0
205	0	0
206	0	0
207	0	0
208	0	0
209	0	0
210	0	0
211	0	0
212	0	0
213	0	0
214	0	0
215	0	0
216	0	0
217	0	0
218	0	0
219	0	0
220	0	0
221	0	0
222	0	0
223	0	0
224	0	0
225	0	0
226	0	0
227	0	0
228	0	0
229	0	0
230	0	0
231	0	0
232	0	0
233	0	0
234	0	0
235	0	0
236	0	0
237	0	0
238	0	0
239	0	0
240	0	0
241	0	0
242	0	0
243	0	0
244	0	0
245	0	0
246	0	0
247	0	0
248	0	0
249	0	0
250	0	0
251	0	0
252	0	0
253	0	0
254	0	0
255	0	0
256	0	0
257	0	0
258	0	0
259	0	0
260	0	0
261	0	0
262	0	0
263	0	0
264	0	0
265	0	0
266	0	0
267	0	0
268	0	0
269	0	0
270	0	0
271	0	0
272	0	0
273	0	0
274	0	0
275	0	0
276	0	0
277	0	0
278	0	0
279	0	0
280	0	0
281	0	0
282	0	0
283	0	0
284	0	0
285	0	0
286	0	0
287	0	0
288	0	0
289	0	0
290	0	0
291	0	0
292	0	0
293	0	0
294	0	0
295	0	0
296	0	0
297	0	0
298	0	0
299	0	0
300	0	0
301	0	0
302	0	0
303	0	0
304	0	0
305	0	0
306	0	0
307	0	0
308	0	0
309	0	0
310	0	0
311	0	0
312	0	0
313	0	0
314	0	0
315	0	0
316	0	0
317	0	0
318	0	0
319	0	0
320	0	0
321	0	0
322	0	0
323	0	0
324	0	0
325	0	0
326	0	0
327	0	0
328	0	0
329	0	0
330	0	0
331	0	0
332	0	0
333	0	0
334	0	0
335	0	0
336	0	0
337	0	0
338	0	0
339	0	0
340	0	0
341	0	0
342	0	0
343	0	0
344	0	0
345	0	0
346	0	0
347	0	0
348	0	0
349	0	0
350	0	0
351	0	0
352	0	0
353	0	0
354	0	0
355	0	0
356	0	0
357	0	0
358	0	0
359	0	0
360	0	0
361	0	0
362	0	0
363	0	0
364	0	0
365	0	0
366	0	0
367	0	0
368	0	0
369	0	0
370	0	0
371	0	0
372	0	0
373	0	0
374	0	0
375	0	0
376	0	0
377	0	0
378	0	0
379	0	0
380	0	0
381	0	0
382	0	0
383	0	0
384	0	0
385	0	0
386	0	0
387	0	0
388	0	0
389	0	0
390	0	0
391	0	0
392	0	0
393	0	0
394	0	0
395	0	0
396	0	0
397	0	0
398	0	0
399	0	0
400	0	0
401	0	0
402	0	0
403	0	0
404	0	0
405	0	0
406	0	0
407	0	0
408	0	0
409	0	0
410	0	0
411	0	0
412	0	0
413	0	0
414	0	0
415	0	0
416	0	0
417	0	0
418	0	0
419	0	0
420	0	0
421	0	0
422	0	0
423	0	0
424	0	0
425	0	0
426	0	0
427	0	0
428	0	0
429	0	0
430	0	0
431	0	0
432	0	0
433	0	0
434	0	0
435	0	0
436	0	0
437	0	0
438	0	0
439	0	0
440	0	0
441	0	0
442	0	0
443	0	0
444	0	0
445	0	0
446	0	0
447	0	0
448	0	0
449	0	0
450	0	0
451	0	0
452	0	0
453	0	0
454	0	0
455	0	0
456	0	0
457	0	0
458	0	0
459	0	0
460	0	0
461	0	0
462	0	0
463	0	0
464	0	0
465	0	0
466	0	0
467	0	0
468	0	0
469	0	0
470	0	0
471	0	0
472	0	0
473	0	0
474	0	0
475	0	0
476	0	0
477	0	0
478	0	0
479	0	0
480	0	0
481	0	0
482	0	0
483	0	0
484	0	0
485	0	0
486	0	0
487	0	0
488	0	0
489	0	0
490	0	0
491	0	0
492	0	0
493	0	0
494	0	0
495	0	0
496	0	0
497	0	0
498	0	0
499	0	0
500	0	0

Cont.

Magnetic Island (Cont.)

Taxon		Sargassum sp.					Lobophora sp.				
[illegible]	19	0	0	0	0	0	1	0	0	0	0
[illegible]	1	0	0	0	0	0	0	0	0	0	0
[illegible]	2	0	24	1	0	0	0	0	0	5	0
[illegible]	3	0	3	1	0	0	0	0	0	0	0
[illegible]	4	0	0	2	0	0	0	0	0	0	0
[illegible]	5	0	5	2	0	0	0	0	0	0	0
[illegible]	6	0	2	7	0	0	2	0	0	0	0
[illegible]	7	0	2	0	0	3	0	0	0	0	0
[illegible]	8	0	2	4	0	0	0	0	0	0	1
[illegible]	9	0	1	0	0	0	0	0	0	0	10
[illegible]	10	0	1	0	0	0	0	0	0	0	0
[illegible]	11	0	1	0	0	0	0	0	0	0	0
[illegible]	12	0	0	3	4	0	0	0	0	0	0
[illegible]	13	0	0	2	4	0	0	0	0	0	0
[illegible]	14	0	0	1	0	0	0	0	0	0	0
[illegible]	15	0	0	1	0	0	0	0	0	0	0
[illegible]	16	0	0	1	0	0	0	0	0	0	1
[illegible]	17	0	0	1	0	0	0	0	0	0	0
[illegible]	18	0	0	0	0	0	0	0	0	0	0
[illegible]	19	0	0	0	0	0	0	0	0	0	0
[illegible]	20	0	0	0	0	0	0	0	0	0	0
[illegible]	1	0	0	0	0	0	0	0	0	0	0
[illegible]	2	0	0	0	0	0	0	0	0	0	0
[illegible]	3	0	0	0	0	0	0	0	0	0	0
[illegible]	4	0	0	0	0	0	0	0	0	0	0
[illegible]	5	0	0	0	0	0	0	0	0	0	0

Russel Island. Depth 1m.

Taxon		Padina tenuis				
CA	1	0	0	1	0	0
CA	2	7	2	4	0	4
CA	3	2	0	4	0	2
CA	4	0	0	0	0	0
CA	5	1	0	0	0	0
CA	6	1	0	8	0	0
CA	7	9	10	8	0	10
CA	8	0	0	4	0	0
CA	9	0	0	0	0	3
CA	10	0	3	0	0	0
CA	11	0	0	5	5	0
CA	12	0	0	0	0	2
CC	1	0	0	0	0	0
CC	2	0	10	9	0	2
CC	3	10	4	0	35	4
CC	1	0	2	1	0	0
CC	2	4	0	0	0	0
CC	3	1	0	0	0	0
CC	1	1	1	26	1	10
CC	2	1	1	0	0	0
CC	3	1	0	0	0	0
CO	1	2	1	2	0	0
PL	1	0	0	0	0	1
PL	2	0	0	0	0	1
SA	1	0	4	0	0	1
MG	1	0	0	0	0	1
MG	2	0	0	0	0	1
MG	3	0	0	0	0	1
MG	4	0	0	1	0	0
MG	5	2	0	0	0	4
MG	6	1	3	0	18	3
MG	7	3	1	1	1	1
MG	8	3	2	1	0	1
MG	9	0	1	0	0	0
MG	10	0	1	1	0	0
MG	11	0	2	0	1	0
MG	12	0	0	1	0	0
MG	13	0	0	9	1	2
MG	14	0	0	0	1	0
MG	15	0	0	0	1	2
MG	16	0	0	0	0	2
MG	17	0	0	0	0	2
MP	1	1	0	0	0	0
MP	2	3	0	1	0	1
MP	3	0	2	2	0	1
MP	4	0	0	1	0	0
MP	5	0	0	1	0	0
MN	1	0	1	0	0	0
MN	2	0	0	0	0	1

Wentworth Reef, Port Douglas. Depth 4m.

Taxon	Sargassum sp.1					Sargassum sp.2					Sargassum sp.3					Padina sp.					Lobophora sp.				
1	0	0	0	0	0	0	4	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	7	0	0	10	0	0	0	0	0	3	2	2	0	4	0	0	0	0	0	0	0	0
3	0	0	2	6	0	0	0	24	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

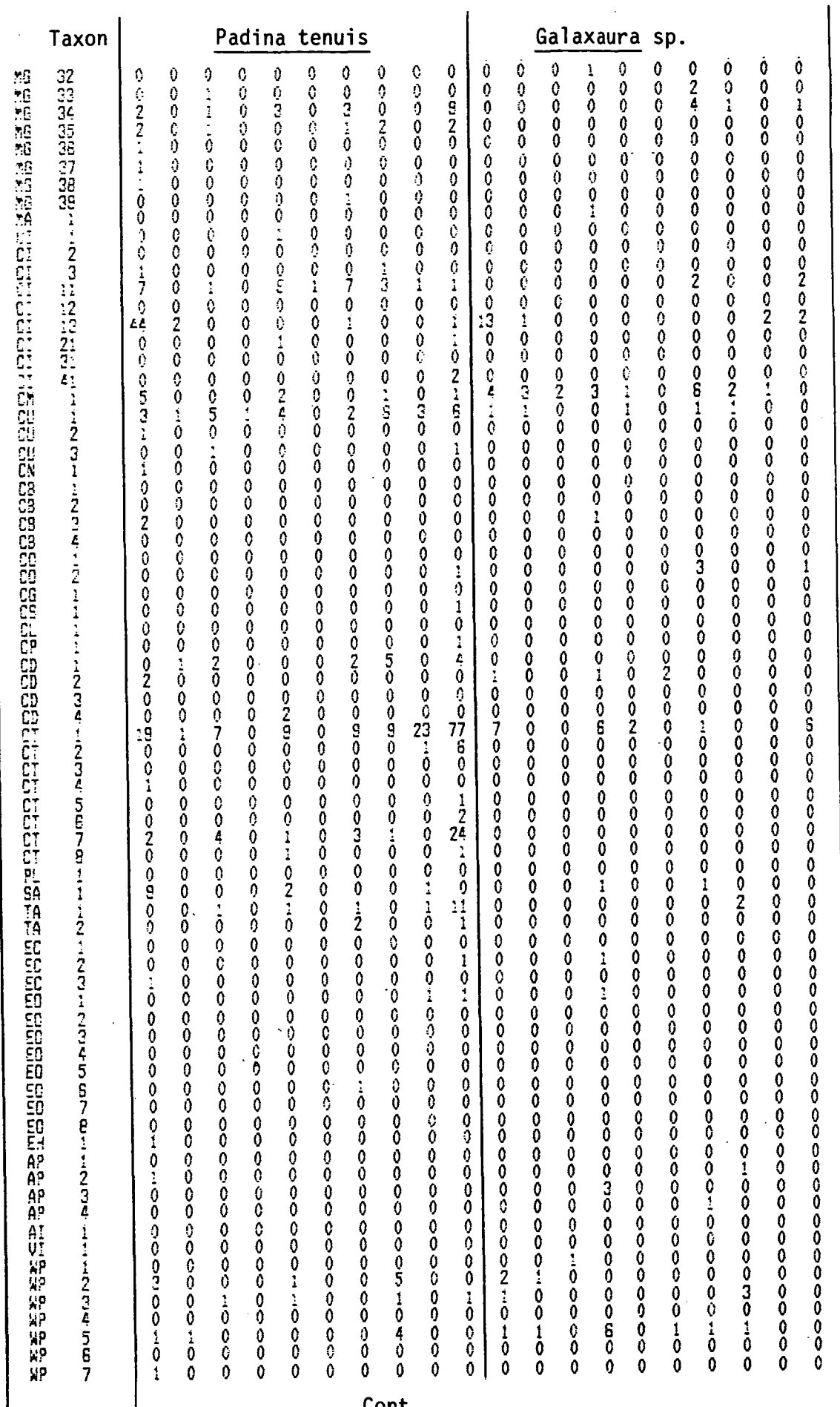
Wentworth Reef (Cont.).

Taxon	Sargassum sp.1	Sargassum sp.2	Sargassum sp.3	Padina sp.	Lobophora sp.
1	0	0	0	0	2
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
XX	0	0	0	0	0
XX	0	0	0	0	0
XX	0	0	0	0	0
XX	0	0	0	0	0
XX	0	0	0	0	0

Lizard Island. Depth 6m.

Taxon	Padina tenuis										Galaxaura sp.									
CA 1	2	0	0	0	0	2	0	0	0	1	0	0	0	1	0	4	2	0	0	0
CA 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 4	0	0	0	0	0	0	9	4	0	0	1	0	0	0	0	0	0	0	0	0
CA 5	7	0	0	0	6	0	2	4	5	0	0	0	0	0	0	0	0	0	0	0
CA 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CA 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 16	0	0	0	0	0	0	7	1	1	5	0	0	0	0	0	0	0	0	0	0
CA 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 18	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0
CA 19	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 20	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CA 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CA 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
CA 27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 28	4	0	0	0	0	0	2	1	0	1	1	0	0	0	2	0	0	0	0	0
CA 29	1	0	0	0	0	0	1	2	0	0	1	0	0	2	0	0	0	0	0	1
CA 30	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0
CA 31	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0
CA 32	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
CA 33	5	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0
CA 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 35	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 36	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 37	1	0	0	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0
CA 38	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CA 39	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA 40	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA 41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 2	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 4	28	0	2	0	15	0	0	7	4	4	5	5	0	0	4	2	0	0	0	1
MG 1	1	0	0	0	0	0	0	0	1	0	1	4	0	0	1	0	0	0	1	0
MG 2	1	0	1	0	0	0	0	2	0	1	0	0	1	0	0	1	0	0	1	0
MG 3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	7	0	0
MG 4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	10	0	0
MG 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 6	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MG 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 9	1	0	0	0	0	0	0	0	0	1	2	1	0	2	1	2	3	2	0	1
MG 10	1	0	0	0	0	0	0	0	0	2	1	0	0	1	0	0	0	1	0	0
MG 11	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MG 12	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MG 13	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
MG 14	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MG 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MG 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 23	3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
MG 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 25	2	0	1	0	0	0	1	4	0	5	0	0	2	0	0	0	1	2	0	0
MG 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 29	2	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
MG 30	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
MG 31	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Cont.



Cont.

Lizard Island (Cont.).

Taxon	Padina tenuis										Galaxaura sp.									
WP 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 11	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
WP 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 13	0	0	1	0	0	0	2	2	0	0	0	0	0	0	0	0	1	0	0	0
WP 14	1	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
WP 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 17	3	0	0	0	1	0	6	0	0	0	0	0	0	0	1	1	2	1	0	0
WP 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 21	1	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 29	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 31	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 32	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 35	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
WP 36	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 37	5	0	0	0	0	0	3	5	1	0	0	0	0	1	1	0	0	1	0	2
WP 38	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
WP 39	0	0	0	0	0	0	0	0	0	2	2	0	0	1	0	0	0	1	0	0
WP 40	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WP 41	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	1	0	0
WP 42	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0
WP 43	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 44	3	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
WP 45	1	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
WP 46	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 47	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 48	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WD 1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
WN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Lizard Island. Depth 0.5m.

Taxon		Turbinaria ornata										Hypnea sp.									
CA	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	2	0	2	0
CA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	3	1	4	6	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
CA	4	0	5	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
CA	5	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
CA	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CA	13	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
CA	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
CA	20	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1
CA	21	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	1	0	0	0
CA	22	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA	23	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CA	24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CA	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CC	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
CC	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	1	0	1	0	0	0	0	1	0	0	0	0	2	0	0	1	0	0	1	0	0
MG	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MG	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	4	0	0	0	0	0	0	0	0	0	0	0	2	4	1	0	0	8	2	4	0
MG	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
MG	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	9	1	0	0	2	0	0	1	0	2	0	0	1	0	0	0	0	0	0	0	0
MG	10	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
MG	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	17	1	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
MG	18	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
MG	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	25	0	0	0	1	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MG	26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MG	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Lizard Island (Cont.).

Taxon	Turbinaria ornata	Hypnea sp.
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	0	0
39	0	0
1	0	0
2	0	0
1	0	0
2	0	0
3	0	0
4	0	0
1	0	0
2	0	0
1	0	0
1	0	0
1	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
1	0	0
1	0	0
2	0	0
1	0	0
2	0	0
3	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
1	0	0
1	0	0
2	0	0
3	0	0
4	0	0
1	0	0
1	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0

Cont.

Lizard Island (Cont.).

Taxon	Turbinaria ornata										Hypnea sp.									
AP 7	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
AP 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
AP 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 12	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
AP 13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
AP 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0
AP 18	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 20	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AP 21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0
AP 22	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
AP 23	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
AP 24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
AP 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AP 28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
AP 29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Lizard Island. Depth 0.5m.

Taxon		Halimeda opuntia										Chlorodesmis fastigiata									
CA	1	0	0	1	2	0	2	1	1	0	2	0	0	0	0	0	1	0	0	0	0
CA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	5	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0
CA	6	3	1	18	1	0	0	4	1	19	4	1	0	0	0	0	0	0	0	1	2
CA	7	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
CA	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CA	10	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	12	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CA	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	16	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	17	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	18	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	19	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CA	20	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	21	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
CA	22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	3	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MG	1	0	0	2	8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
MG	2	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MG	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	4	0	1	0	10	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
MG	5	0	0	6	1	0	0	0	2	0	0	0	0	0	0	1	2	0	0	0	0
MG	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	7	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	8	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MG	9	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	12	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MG	13	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	19	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
MG	20	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	21	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	22	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
MG	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
MG	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
MG	25	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
MG	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Taxon	Halimeda opuntia										Chlorodesmis fastigiata									
MG 31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG 39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 4	3	1	10	12	1	8	3	1	21	8	0	1	0	0	0	0	1	0	0	0
CC 5	0	0	0	2	0	0	0	0	1	4	0	0	0	0	0	0	1	0	0	0
CC 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
CC 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 11	0	0	0	1	0	0	1	0	3	0	1	1	0	0	0	0	1	0	0	0
CC 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CN 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CB 2	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CB 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB 7	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
CS 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CL 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 2	0	0	0	2	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0
CD 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD 4	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 1	6	0	1	10	1	0	5	2	27	6	8	0	0	0	0	0	1	0	0	0
CT 2	0	0	0	3	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
CT 3	0	0	0	12	3	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
CT 4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 5	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CT 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL 1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
SA 1	0	0	0	5	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TA 1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TA 2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC 1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ED 1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ED 2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ED 3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
ED 4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ED 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ED 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ED 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ED 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EH 1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AP 1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
AP 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI 1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 1	0	2	1	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WP 2	0	0	1	1	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
WP 3	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0
WP 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP 5	0	0	2	8	2	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
WP 6	0	0	0	3	0	1	1	0	0	0	1	0	0	0	2	0	0	0	0	0

Cont.

Lizard Island (Cont.).

Taxon		Halimeda opuntia										Chlorodesmis fastigiata									
WP	7	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	8	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP	9	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	10	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP	11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	14	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
WP	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	16	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	17	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	21	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
WP	22	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	23	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WP	26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WS	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN	2	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0

Lizard Island Region. Depth 0.5m.

Taxon		Yonge Reef Halimeda opuntia										Lizard Island Halimeda cylindracea									
CA	1	33	4	1	1	1	0	0	10	2	0	67	41	13	63	122	23	19	21	39	51
CA	2	0	0	0	0	5	0	0	0	0	0	13	84	59	64	81	37	41	50	64	46
CA	3	0	0	0	0	0	0	0	0	0	0	16	50	9	16	47	13	15	23	12	24
CA	4	1	0	0	0	0	0	0	0	0	0	43	136	89	163	143	19	43	33	39	136
CA	5	0	0	0	0	0	0	0	1	0	0	19	4	7	3	29	9	2	14	3	20
CA	6	0	0	0	0	0	0	0	0	0	0	0	4	0	2	4	0	1	1	0	5
CA	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	8	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
CA	9	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	1	0	0	5
CA	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	2
CA	12	0	0	0	0	0	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0
CA	13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
CA	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
CA	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
CA	16	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	18	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	19	8	1	2	0	2	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	20	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	21	0	1	9	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
CA	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	23	0	0	9	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	26	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	27	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	0
CC	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	4
CC	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	1	0	0	0	0	0	0	0	0	0	0	9	0	0	6	9	2	0	0	0	1
MG	2	0	0	0	0	0	0	0	0	0	0	8	0	0	0	3	0	0	0	2	1
MG	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	4	0	4	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	5	0	0	8	1	1	2	3	1	0	1	0	0	0	0	1	0	0	0	0	0
MG	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
MG	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
MG	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	23	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	25	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	27	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	28	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Cont.

Lizard Island Region (Cont.).

Taxon		Halimeda opuntia										Halimeda cylindracea									
MG	29	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MG	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MG	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	2	0	0	0
CT	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	3	4	1	2	1	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0
CT	11	11	0	0	1	0	11	0	11	1	2	58	9	9	13	2	2	1	12	9	64
CT	12	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
CT	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	31	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CT	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CM	1	1	0	0	0	0	2	0	0	1	0	0	0	0	0	1	0	0	1	0	0
CO	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
CO	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
CO	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CB	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	2	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CS	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CS	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CP	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CP	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
CD	2	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CD	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	1	8	1	5	8	2	2	4	1	1	1	1	3	3	1	5	3	0	5	2	15
CT	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
CT	3	0	0	1	0	0	0	0	0	0	0	0	3	0	0	1	3	1	2	0	3
CT	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SA	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TA	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
TA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	14
EC	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
EC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EO	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	1	0
SO	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO	4	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SO	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EO	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO	7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SO	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SO	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP	2	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AP	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	1	1	2	1	1
VI	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0
WP	1	0	0	1	1	0	0	0	1	0	1	2	1	0	1	5	4	1	0	7	1
WP	2	1	0	4	0	1	0	1	0	0	0	4	0	0	4	2	1	0	0	0	3
WP	3	2	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0
WP	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
WP	5	1	0	1	0	0	0	0	0	0	1	2	3	0	0	4	1	1	0	0	1

Cont.

Lizard Island Region (Cont.).

Taxon		Halimeda opuntia										Halimeda cylindracea									
WP	6	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
WP	7	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0	0	0	0
WP	8	1	0	1	0	0	0	0	0	1	1	0	3	0	0	0	1	0	0	0	1
WP	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
WP	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
WP	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
WP	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
WP	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0
WP	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
WP	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
WP	17	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
WP	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	21	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	22	1	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	31	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	32	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
WP	33	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	34	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	35	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	36	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	37	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WP	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WD	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WN	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0